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ABSTRACT

The monograph examines objectives and preparation of environmental impact statements (EISs) and assesses the degree to which these documents are successful in monitoring the environmental impact of development in the United States. The document is part of a series of resource papers developed to supplement college-level geography textbooks. The document is presented in eight chapters. Chapter I defines an EIS as a mechanism to ensure that the implications of projects are carefully considered before the projects are undertaken. Chapters II and III address preparation and review of an EIS at the federal level. Chapter IV explains how EIS requirements interact with other laws and regulations. Chapter V presents basic topics to be included in any EIS. Chapter VI identifies problems related to the EIS process. Chapter VII suggests resources for additional information, and the final chapter discusses the geographer's role in the EIS process. The document concludes with a bibliography and a listing of EIS-related legal cases. (DE)

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ENVIRONMENTAL IMPACT STATEMENTS

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FOREWORD

In 1968, the Commission on College Geography of the Association of American Geographers published its first Resource Paper, *Theories of Urban Location,* by Brian J. L. Berry. In 1974, coinciding with the termination of NSF funding for the Commission, Resource Paper number 28 appeared, *The Underdevelopment and Modernization of the Third World,* by Anthony R. deSouza and Philip W. Porter. Of the many CCG activities, the Resource Papers Series became an effective means for permitting both teachers and students to keep abreast of developments in the field.

Because of the popularity and usefulness of the Resource Papers, the AAG applied for and received a two-year grant from NSF to continue to produce Resource Papers and to put the series on a self-supporting basis. The 1977 Series was the first group produced entirely with AAG funding.

In an effort to increase the utility of these papers, the Resource Papers Panel has attempted to be particularly sensitive to the currency of materials for undergraduate geography courses and to the writing style of these papers. The present Panel continues to affirm the original purposes of the Series, which are quoted below:

> The Resource Papers have been developed as expository documents for the use of both the student and the instructor. They are experimental in that they are designed to supplement existing texts and to fill a gap between significant research in American geography and readily accessible materials. The papers are concerned with important concepts or topics in modern geography and focus on one of three general themes: geographic theory; policy implications; or contemporary social relevance. They are designed to complement a variety of undergraduate college geography courses at the introductory and advanced level.

The Resource Papers are developed, printed, and distributed under the auspices of the Association of American Geographers. The ideas presented in these papers do not imply endorsement by the AAG.

Many individuals have assisted in producing these Resource Papers, and we wish to acknowledge those who assisted the Panel in reviewing the authors' prospectuses, in reading and commenting on the various drafts, and in making helpful suggestions. The Panel also acknowledges the perceptive suggestions and editorial assistance of Jane F. Castner of the AAG Central Office.

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SUGGESTIONS FOR CLASS USE

This resource paper may be used as supplementary reading in advanced physical geography courses. Or it might serve as a focal point for a studio course on environmental impact assessment. In particular, Chapter Five dealing with how to prepare an environmental impact statement (EIS) is longer than other sections so that it can be the basis for a class project preparing an environmental assessment of a proposed housing or shopping center development.

If you choose to do a class project, the legal/administrative rules governing your site will be unique and therefore will have to be gathered from relevant state, county, local, and special government agencies. In one of the senior author's classes, some students played the role of the developers, others were the environmental agency. Two ex-students who work in the EIS process served as factual legal issue referees. A class project can also be closely integrated with field methods and cartography courses.

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INTRODUCTION

Population growth, rising expectations, and technological changes have created serious environmental problems. Society increasingly faces a dilemma of balancing the goals of maximizing our sense of well-being while minimizing serious health and environmental abuses. In order to try to balance these two goals, we must know the effects of proposed actions and the level of risk acceptable to the public. Neither set of information is easily derived. The harmful effects of maximizing society's satisfaction are difficult to derive because the environment and the agents that have an impact upon it are diverse and intertwine in complex and, in many cases, unknown ways. Judging the acceptable risk likewise is difficult because of a lack of information and because the decision is ultimately a value judgment.

Faced with a balancing dilemma, precipitated in some part by a lack of definitive information, the United States government, followed by many state and local governments, has turned to the preparation of formal environmental impact statements to try to answer some of the information-related questions. As the reader will see, the environmental impact statement has been called everything from a panacea to a waste of time. Whatever its accomplishments and weaknesses, the EIS is the major legal document monitoring the impact of development in the United States and therefore is the focal point for environmental impact assessment in the United States.

This paper reviews the EIS process from the perspective of the student who has had one or two courses in physical, cultural, and economic geography. It is not intended to break new ground for the expert, but rather to encourage more geographers to get involved by providing an overview that, while comprehensive, stresses those things normally familiar to geographers. Given this perspective we have focused on the points of contact among the information learned in systematic geography courses, (e.g., soils, meteorology, and land use) and the EIS process (Chapter Five). In addition, assuming that the reader has no or little previous knowledge about the EIS process, the paper provides the following basic information:

1. What is an EIS (Chapter One)
2. Who must prepare an EIS? (Chapter Two)
3. How is an EIS reviewed? (Chapter Three)
4. How do EIS requirements interact with other laws and regulations? (Chapter Four)

Having been exposed to the EIS concept and how it relates to the information normally taught in geography courses (Chapter Five). we turn to the accomplishments and problems of the EIS process and where it may go in the future (Chapter Six). Finally, sources of additional information about the EIS process and the role of the geographer in the EIS process are reviewed in the last sections of the paper (Chapters Seven and Eight).

Before beginning, we would like to identify five topics that, if space permitted, we would have addressed in this paper and that the reader would benefit from studying. Two of the topics are historical: the long history of man-land studies in geography and their relationship to the EIS (see Chapter Eight); and the history of the EIS—its relationship to the environmental movement of the 1960's (Mikesell, 1974), the Federal government's passage of the National Environmental Policy Act (NEPA), and the history of NEPA's progenies at the state and local scales. A third topic is environmental impact assessment in the United States compared with assessments in other countries (e.g., Conservation Foundation, 1978). Fourth, public participation in the EIS process has unfortunately only been touched upon in this paper. We regret the intentional neglect because public participation can be tied to the environmental perception literature, and public participation is a means of getting concerned geographers involved who do work for agencies and firms that prepare EIS's. Finally, it is important that the reader recognize that Federal, state, and local EIS processes are not identical. Space permitting, we would have introduced exemplary state processes to highlight this crucial fact.

I. WHAT IS AN EIS?

The environmental impact statement (EIS) is a mechanism to ensure that major projects or programs undergo comprehensive review prior to construction or implementation. The review entails a multidisciplinary, multiagency, and public assessment of the environmental, economic, and social impacts of project or program proposals, as well as consideration of alternative proposals for accomplishing public agency and private interest goals.

An underlying premise of the EIS is that substantive decision making will improve and a better balance will emerge between public agency and private interest goals and environmental concerns if a broad range of environmental attributes and alternatives to a proposed action are examined before final decisions are solidified (Anderson, 1973). Since agency actions are open to comment from other agencies and from the public, the EIS mechanism highlights the fact (known to geographers through a long history of man-land studies) that actions do not occur in isolation and often have important effects on the environment. In order to avoid or minimize adverse impacts, the EIS process can aid decision makers in identifying actions likely to degrade environmental quality.

NEPA

Whereas the process of studying the environmental impact of development has a long history in academic fields like geography, the preparation of an EIS was initially mandated at the Federal scale under Public Law 91-190—the National Environmental Policy Act (NEPA). NEPA became effective on January 1, 1970. Broadly defined, the goal of this legislation is to

> . . . create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans. [P.L. 91-190, Chap. 55, 4331 (9)]

The Federal EIS has been described as "an action forcing provision" which orders agencies to act in accordance with the goals of NEPA (Anderson, 1973). Title I, Section 102(2)(c) of NEPA requires all Federal agencies to prepare an EIS on any ". . . proposals for legislation and other major Federal actions significantly affecting the quality of the human environment" (42 U.S.C. 4332).[1]

NEPA, specifically [Section 102(c)], requires that each EIS must contain a detailed statement describing the following five items:

(i) The environmental impact of the proposed action
(ii) Any adverse environmental effects which cannot be avoided should the proposal be implemented
(iii) Alternatives to the proposed action
(iv) The relationship between local short-term uses of the human environment and the maintenance and enhancement of long term productivity
(v) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Slowly reread the five items. You probably can understand why there has been considerable confusion about the degree of detail necessary in addressing these five items. Ideally, their consideration should enlighten those who review them as to whether or not a proposal adequately falls within environmental standards and is socially beneficial, or whether one or more aspects of the proposal are in potential violation of environmental standards and constitute grounds for halting or modifying development or implementation. The five items that must be addressed, however, are stated in general terms and may be interpreted differently for each project. For example, the worst deficiency of the EIS, some contend, is the less than adequate discussion of alternatives to the proposed action. The alternatives section is frequently perfunctory, often ignoring significant alternatives (Odell, 1976). Another typical criticism asserts that the "generalness" inherent in the five items allows the document to become too lengthy, esoteric in technical jargon, and often myopic in its failure to recognize the larger potential consequences of proposed actions.

Whereas EIS implementation has drawn a good deal of criticism, on the other hand, the EIS has been hailed as an instrumental tool for decision making ". . . which has introduced a new set of values to be considered besides technologic and economic aspects" (Oregon State University, 1973). Criticism and praise of the Federal, state, and local EIS processes abound, and you will encounter these throughout the paper.

NEPA is administered by the Council on Environmental Quality (CEQ), established by NEPA, under Title II, Section 201. The CEQ can neither demand the preparation of an EIS nor order changes in proposed projects. The role of the CEQ is to advise the President on environmental policy and to prepare an annual report describing the status of and trends in the national environment. The CEQ receives important judgmental inputs from Federal agencies, especially the United States Environmental Protection Agency (USEPA).

Under authority specified in Executive Order 11514, the CEQ has issued guidelines for agency implementation of NEPA. The guidelines set forth the rules and procedures agencies must follow in the preparation of an EIS. These guidelines, with the aid of legal interpretation, have had the effect of defining the scope of the EIS document and the review responsibilities of the agency which prepares it.

Although the guidelines have been helpful in setting the ground rules for procedure, they have also been found to be incomplete, insufficient, and in need of modification. CEQ issued its first set of guidelines in April 1971 and published proposed revisions in May 1973 which became effective in January 1974. Those in-

[1] Federal laws are cited by section of the U.S. Code.

terested in the full text of guidelines may consult the *Federal Register,* where content and format requirements are specified in detail (36 *Federal Register,* April 1971, 7724 and 38 *Federal Register,* May 1973, 10856).[2]

In December 1977 the CEQ proposed to "streamline" the EIS process by issuing new guidelines. These proposed guidelines may become regulations under the authorization issued by President Carter in Executive Order 11911 (May 24, 1977). This latest set is in response to criticism from environmentalists, industry, and governmental officials that the EIS process is too cumbersome and time-consuming and generally ineffective in properly considering the environmental consequences of government projects. According to a recent press release, the proposed changes would greatly affect the content and format specifications of the EIS document in the following ways (Shabecoff, 1977):

(1) limit statements to 150 pages, and 300 pages in the case of complex proposals.

(2) require statements to be written in "plain English" and avoid technical jargon.

(3) require a short summary for each statement.

(4) establish a time limit for submitting statements.

(5) establish a framework for interagency cooperation in preparing the statements and resolving disputes among the agencies.

(6) require documents to be accurate and objective.

(7) ensure that an involved agency follows up on its statement and deals with problems resulting from its actions.

To the authors and EPA people we spoke with it appears that these proposed regulations, if implemented, would have a radical effect upon the EIS process. The proposed CEQ regulations have received a great deal of attention within the Washington, D.C. bureaucratic milieu. They may be substantially modified by the time they reach their final form.

Although Federal EIS required under NEPA is the major focus of this Resource Paper because of space limitations, we will also highlight similar requirements at the state and local levels. Assessing impacts on these geographical levels usually entails some modifications of the Federal NEPA requirements. Burchell and Listokin (1975: 39) suggest that most "variations are superficial ones reflecting particular local concerns." For example, the California Environmental Quality Act requires impact statements to discuss mitigation measures (to lessen adverse impacts), and a description of growth-inducing impacts. Whereas these differences may appear to be superficial, Schmid (1978) argues that these differences "amount to thousands or hundreds of thousands of dollars in consulting fees, and perhaps months or years of time to collect and analyze data."

Summary

The EIS has been defined as a mechanism designed to ensure that the implications of projects are carefully considered before construction. The Federal NEPA process became effective on January 1, 1970. It is administered by the CEQ. NEPA guidelines have been substantially modified and probably will continue to be. Many state and local agencies following the NEPA example have written NEPA-like requirements.

II. WHO MUST PREPARE AN EIS?

Now that we have introduced the EIS concept and its legal foundation at the Federal scale, we will systematically address the major issues raised in the overview as well as additional topics. We begin with the issue of who must prepare an EIS.

National Scope of NEPA

The National Environmental Policy Act requires "all agencies of the Federal Government [to] include in every recommendation or report or proposal for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official" (42 U.S.C. 4332). In the original act, states and municipalities "owe no duties under NEPA, but may be subject to alternative environmental legislation fashioned after NEPA" (Anderson, 1973: 106).[3] A "responsible official" in an agency is the appointed environmental officer who determines whether or not an action should be accompanied by an EIS. However, the ultimate responsibility rests on the chief administrator of the individual agency.

The requirement to prepare an EIS under NEPA applies to a wide variety of actions by Federal agencies. The following list points out some of the major actions which may require a statement (Jenny, 1973: 11): (1) legislative proposals; (2) planned Federal projects; (3) projects developed through Federal grants; (4) changes in agency policies and operating procedures; (5) actions requiring Federal licenses, permits, and other approvals;

[2]The *Federal Register* is published daily (except for Saturdays, Sundays, and Federal holidays) by the National Archives and Records Service. It includes all rules and regulations pertaining to Federal legislation as well as information on grants and contracts included in Federal legislation. It also includes the complete texts of bills passed by Congress. In the citation, the number preceding *Federal Register* is the volume number, and the number after the date is the page number.

[3]Whereas NEPA did not assign responsibility to local governments, the Housing and Community Development Act of 1974 (P.L. 93-383) transferred NEPA review responsibilities from the U.S. Department of Housing and Urban Development to municipalities that accept Community Development Block Grant Funds.

and (6) those actions with impacts that may be controversial.

This list is extremely broad but not exhaustive. For many agencies certain actions almost automatically require an EIS. Other actions by agencies may balance on a threshold of determination. Agencies often look to NEPA case law to decide whether they should prepare an EIS. Finally, an environmental official ("responsible official") may decide that an agency action will have very little impact at all, and only an assessment subject to disclosure and challenge of these minor impacts is necessary, not a full-blown EIS. This last action is perfectly within the boundaries of the NEPA law.

Role of the Courts in Interpreting NEPA

In passing NEPA and authorizing the CEQ to issue guidelines for agency compliance [especially with respect to Section 102(2)(c)], Congress intended Federal agencies to monitor their actions to preserve and enhance the environment for future generations. The scope of the EIS requirement is, however, sufficiently broad under NEPA that the resulting abundance of case law comes as no surprise. The courts have been called upon to interpret both Section 102(2)(c) and the CEQ guidelines. An exhaustive discussion of the courts' role in interpreting the EIS requirement is beyond the scope of this paper (see Anderson, 1973; Council on Environmental Quality, 1974, 1975, 1976a, and 1976b; Coope, 1977). Instead, we provide a brief outline of some of the major court decisions concerning compliance with Section 102(2)(c) of NEPA.

As indicated above, agencies designate an environmental official, acting on behalf of that agency's chief administrator, who decides whether or not an action should be accompanied by an impact statement. If an EIS is prepared and properly reviewed, the chief official can accept or reject the document. If the document is accepted, the path is clear for implementation of the proposal, with or without modifications recommended in the EIS. In Town of Groton v. Laird, 1972, a Federal District Court held that an analysis of a project resulting in the conclusion by the chief official that no "significant" effects are likely to occur was upheld in the absence of proof that the decision was "arbitrary, capricious, an abuse of discretion or otherwise not in accordance with law" (Rose, 1974b: 248).

Who May Sue for Non-Compliance with Section 102(2)(c)?

The list of potential parties or plaintiffs who may sue a Federal agency for non-compliance with NEPA Section 102(2)(c) includes citizens, citizen groups, business corporations, and other governmental agencies. When an agency action is challenged under NEPA, the plaintiff must exhaust all available remedies offered under the Administrative Procedures Act (Rose, 1974a). To enter trial court the plaintiff must prove that he or she has standing to sue.

Two factors affect standing to sue with respect to the plaintiff. First, the suit must be based on an injury in fact – which means that plaintiff must prove that he or she has or will suffer direct injury from the action, i.e., economic, aesthetic, recreational, etc. The second ground is termed zone of interest – which means that the legal issue raised must in fact be real and not a bogus issue contrived to answer a hypothetical rather than a real legal matter. These factors are two tests that must be met in every instance of attempt to bring suit. The following are two cases exemplary of standing:

(1) Sierra Club v. Morton (1972): The Supreme Court held that the plaintiff lacked standing because the issue was not raised on behalf of a club member who alleged personal loss resulting from the proposal to convert a wildlife refuge into a public recreational area.

(2) West Virginia Highlands Conservancy v. Island Creek Coal Company (1971): The court held that the company's plan to convert a portion of the Otter Creek area would deprive the conservancy of its special interest in studying the area and the conservancy had grounds for filing suit.

What Constitutes a "Major Federal Action"?

Section 1500.6(a) of the CEQ guidelines states that actions which significantly impact the environment are characteristically major (38 *Federal Register,* August 1, 1973). The following cases are often cited with regard to determining "major Federal actions:"

(1) San Francisco Tomorrow v. Romney (1973): The Court of Appeals held that continued financing of an urban renewal project where the contract was entered into before enactment of NEPA even though second and third year grants were approved subsequently did not constitute a "major Federal action" (Rose, 1974: 248).

(2) Citizens Organized to Defend the Environment v. Volpe (1972): The court held that a "major Federal action" is "one that requires substantial planning, time, resources, or expenditures" (Coope, 1977: 22).

Although the threshold of planning, time, resources, and expenditures is not firmly established, the following cases may serve as examples of major and non-major actions (Table 1).

What Constitutes a "Significant" Action?

Lacking a firmly established Congressional or administrative interpretation of an action that will "significantly" affect the environment, the courts have reached the following conclusions:

(1) Save Our Ten Acres v. Kreger (1973): The Court of Appeals remanded the case to a lower court "to determine whether the proposed construction of a federal office building on a downtown site in Mobile, Alabama" would have a significant effect on the quality of the human environment. The EIS in this case failed to make such considerations (Rose, 1974: 248).

(2) Town of Groton v. Laird (1972): The District Court held in the lack of showing that the determination by the "responsible official" that an action did not "significantly" impact the environment was arbitrary, capricious, or an abuse of discretion, the deter-

TABLE 1. COMPARISON OF MAJOR AND NON-MAJOR ACTIONS*

Major	Non-Major
Channelization of sixty-six miles of creek, expenditure of $706,684.00 of Federal funds, several years of planning	Introduction of 727-200 jets into Washington National Airport to replace previously used 727-100 jets
A five-block urban renewal project in downtown Washington, D.C.	The fencing of 6,800 acres of land around a reservoir by the Department of Interior
Construction of two nine-story buildings in Manhattan (one to be used as a correctional facility) at a cost of $20,000,000.00	Fourteen-block city street widening project, total cost: $651,515.00, Federal contributions: $313,000.00
Conversion of twelve miles of two-lane highway to a four-lane freeway in rural Wisconsin	Secretary of Transportation's approval of specifications for moving mining equipment across Federal-aid highway ten times in forty years
Sale of fifteen million board feet of timber on Forest Service land	Change in Forest Service timber set-aside program which would permit higher percentage of timber to be harvested by small businesses but would not change total amount of timber harvested
Provision of a mortgage guarantee of $4,000,000.00 and interest grant of $156,000.00 by HUD to a private developer for construction of low-income housing	Decision of Federal Trade Commission to initiate antitrust enforcement proceedings against construction materials company

*Adapted from Coope, 1973: 23-24, and Anderson, 1973: 77-79.

mination will be upheld as valid (Rose, 1974: 248).

(3) Citizens Environmental Council v. Volpe (1972): The Court of Appeals held that the "phrase [significantly impacting the quality of the human environment] must be broadly construed to give effect to the purposes of NEPA. A ripple begun in one small corner of an environment may become a wave threatening the quality of the total environment" (Coope, 1977: 26).

Adequacy of an EIS

Case law involving the question of what constitutes an adequate or inadequate EIS is voluminous. The following list of cases briefly outlines some of the major legal interpretations.

(1) Calvert Cliffs Coordinating Committee, Inc. v. United States Atomic Energy Commission (1971): The Court of Appeals held that in order for a statement to be adequate the agency was obligated to consider the information they developed in good faith. To do so the agency must make explicit the "trading off or balancing of environmental factors against economic and technical ones." The rubber stamp procedure used to authorize decisions without regard to the EIS automatically attests to the inadequacy of the statement and is grounds for suit based on non-compliance (Anderson, 1973: 247).

(2) Environmental Defense Fund v. Corps of Engineers (1971): The court in the Gillham Dam case held that "at the very least NEPA is an environmental full disclosure law" (Anderson, 1973: 201).

(3) Keith v. Volpe (1972): The court held that an agency is required to discuss complete abandonment of a project in the EIS in order to be adequate (Coope, 1977: 33).

(4) Farwell v. Brinegar (1973): The court held that while the search for alternatives need not be exhaustive, "agencies must consider . . . reasonably available . . . alternatives to 'the fullest extent possible' " but not those which are "speculative and remote" (Coope, 1977: 34).

Delegation of the Preparation of an EIS

Congress intended the responsibility for the preparation of an EIS to be placed on the Federal agency. However, the court has interpreted this as meaning the agency must be involved in but need not undertake the entire preparation.

(1) Conservation Society of Southern Vermont v. Secretary of Transportation (1973): The Court of Appeals held that a statement prepared by a State highway agency (the recipient of Federal aid) which was reviewed and adopted by the Federal Highway Administration did not satisfy the requirements of NEPA (Council on Environmental Quality, 1974: 397). An amendment to NEPA (P.L. 94-83, August 9, 1975), called the "highway amendment," renders the above case obsolete because it allows state agencies of statewide jurisdiction to prepare Federal EIS's.

(2) Greene County Planning Board v. Federal Power Commission (1972): The Court of Appeals held that the use "in connection with public hearings on an applicant's proposal, of the applicant's environmental analysis rather than an impact statement independently prepared by its own staff, violated the policies of NEPA" (Council on Environmental Quality, 1974: 396).

(3) Life of the Land v. Brinegar (1973): The Court of Appeals held that NEPA was satisfied by the Federal Aviation Administration's active participation in, and review of, an impact statement prepared by a private

consulting firm which had a financial interest in the approval of the project (Council on Environmental Quality, 1974: 397).

What Actions Constitute a Program Rather Than A Project?

A program EIS differs from a project EIS in that the first in usually more comprehensive and less detailed. Rather than assessing a single action, the program statement assesses the cumulative effects of a number of related individual actions. An example is the program for breeder reactors under consideration by the Nuclear Regulatory Commission as opposed to a single light water reactor project. At this time, given the shortcomings of program statements, it does not seem to us that they are a substitute for program policy assessments. More information on program statements can be found in Council on Environmental Quality, 1976b: 641-642.

There is no set rule-of-thumb for determining whether an action constitutes a program or just a project. The following cases point out the somewhat vague logic of the court on program statements:

(1) Scientists Institute for Public Information v. Atomic Energy Commission (1973): The Court of Appeals held that an agency should address the action in terms of a four-point balancing test: (a) how soon will the program come to fruition, (b) how much is known about the effects of implementation of the program, (c) to what extent are irretrievable commitments being made and options precluded, (d) how severe will the impacts be (Council on Environmental Quality, 1975: 642).

(2) Sierra Club v. Morton (1975): The Supreme Court held that the leasing of public lands by the Department of Interior in the northern Great Plains Region for coal development was not a Federal action, and since Interior was already developing a program EIS for national coal development, they should not be required to prepare one in this instance (Council on Environmental Quality, 1976b: 134).

The Spatial Distribution and Temporal Record of EIS's Filed Under NEPA

CEQ reports in the *102 Monitor,* approximately 8,588 draft or final statements submitted for review since the 1970 implementation of NEPA (Council on Environmental Quality, November 1977). Ten agencies have each prepared over 100 draft or final impact statements. The distribution of EIS's prepared among the ten agencies varies considerably (Figure 1). The Department of Transportation submitted 3,428 impact statements for CEQ review, whereas the Department of Commerce submitted 123. These ten agencies are responsible for about ninety-three percent of all Federal agency impact statements submitted.

The number of annual draft and final statements has been declining from a peak in 1971 (Figure 2). This peak is partially explained by the large number of statements prepared by the Department of Transportation after integrating the Section 102(2)(c) process into their decision making process. These statements represented analyses of projects that had been planned prior to and shortly after passage of NEPA, but required since they were, for the most part, not at the implementation stage.

The 1973 data in Figure 3 illustrate the spatial distribution of draft and final impact statements under NEPA. The map indicates substantial Federal activity in California, Florida, Texas, New York, and Pennsylvania. Much less activity is suggested throughout New England and several of the Gulf and Mountain States. The map, however, represents the undiscriminated amount of EIS's prepared, and not the type of actions or Federal agencies involved. Nor does the writing of many EIS's mean that the EIS process has had an important impact on development. The spatial distribution and correlates of EIS activity are areas deserving greater attention in future research.

An Overview of State EIS Processes

Like many pieces of Federal legislation, an important effect of NEPA has been that it has influenced state, county, and local governments to include environmental impact analysis in their general planning. Some of the state acts are referred to as "little NEPA's" because they are fashioned after the Federal model. Although some states have actually adopted portions of the language found in NEPA, they should not be assumed to be the same. In order to grasp the subtle as well as the salient differences between NEPA and other environmental legislation or policies, there is no recourse other than reading the contents of each document. A helpful reference on this topic is *The Environmental Impact Handbook* (Burchell and Listokin, 1975, and forthcoming) which contains an appendix listing political subdivision (i.e., state, county, municipal, other), EIS requirements or proposals, and the official or department to get in touch with for specific information. Similar information can be obtained from the fifth and sixth annual reports prepared by the Council on Environmental Quality (Council on Environmental Quality, 1974, 1975).

Although space does not permit us to review state EIS processes, the NEPA regulations or legislation at the state, regional, and local levels may be roughly sorted into three general categories. The first category consists of legislation defined for an entire geographical entity or for broad categories of proposed activity or for both. The second category involves legislation of specialized application that has a more narrow focus either geographically or on the type of development. The third category is comprised of a wide variety of administratively promulgated rules and regulations that may be roughly equivalent to parts or all of the EIS requirement in NEPA.

Currently thirty-nine states require formal EIS preparation (Figure 4). Eighteen states have enacted environmental legislation with an EIS requirement of general applicability. Nineteen states have specialized EIS statutes. Two states have administratively promulgated EIS requirements for specific state activities. Eleven

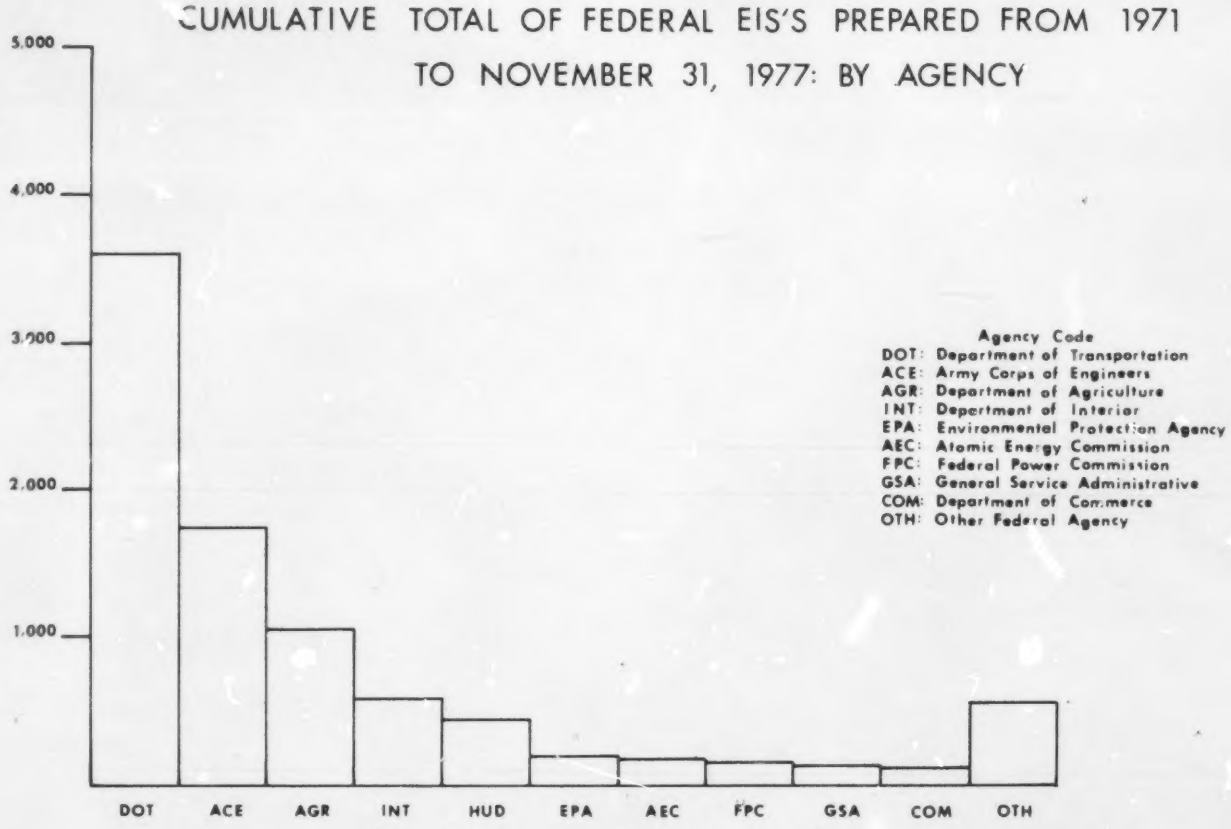

Figure 1. Source: CEQ, *102 Monitor,* June 1977.

states have administratively promulgated EIS requirements for specific state activities. Eleven states lack formal EIS requirements. The reader should note that these categorizations are only meant as a rough distinction. For instance, New Jersey has both statutory and administrative requirements for the preparation of an EIS, but the map illustrates only the general category because it is the more comprehensive classification.

Using Section 102(2)(c) of NEPA as a model, we can compare the variety of state-required EIS's. Some major differences involve: (1) content requirements; (2) applicability to public or private actions; (3) administrative or overseeing agency; (4) preemption with regard to NEPA; and (5) the role of public participation. With regard to content requirements, some states such as Massachusetts limit the discussion of impacts "to those relating to natural environmental resources" (Burchell and Listokin, 1975: 8). Indiana and Washington require an EIS prepared by state agencies to include the identical five items found in Section 102(2)(c) of NEPA. California requires a discussion of mitigation measures to minimize adverse impacts and growth-inducing impacts in addition to the five EIS requirements in NEPA (Council on Environmental Quality, 1974: 403). In contrast, some states, such as Arizona and Virginia, have EIS provisions that amount to an abridged version of the five NEPA content requirements.

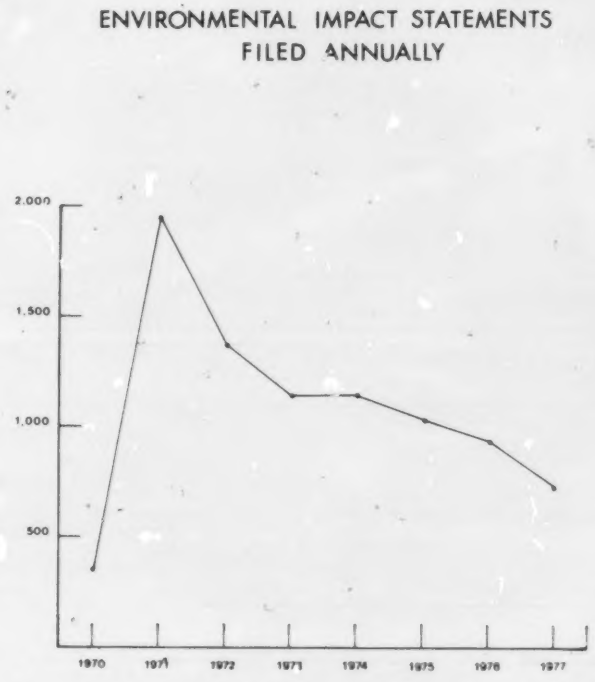

Figure 2. Derived from: CEQ, *102 Monitor,* 1971 to 1977.

THE SPATIAL DISTRIBUTION OF ENVIRONMENTAL IMPACT STATEMENTS: 1973

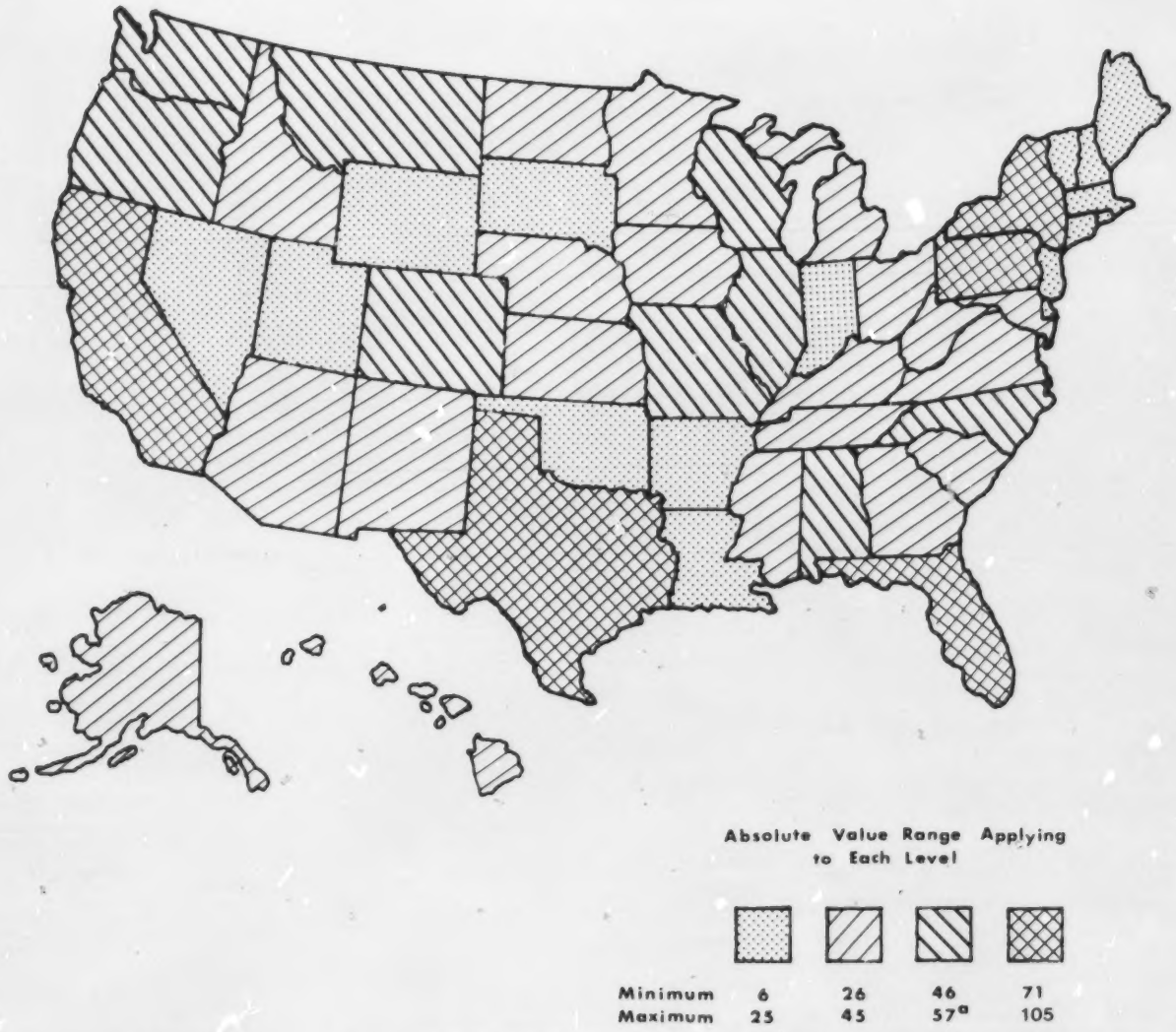

Figure 3. Source: CEQ, *102 Monitor,* January 1974.
[a]No state had between 58 and 70 cases.

In view of the diversity of state EIS requirements, the question of applicability to private or public action is best answered by the appropriate legislation or administrative regulations. Section 102(2)(c) of NEPA mandates the preparation of an EIS for all "major Federal actions." However, its provisions also apply to actions which involve the issuance of a Federal permit, license, or certification; so indirectly NEPA covers private actions requiring Federal agency approval such as the Trans-Alaskan pipeline proposal. The State of California has been supported in a more direct approach by the California State Supreme Court which held in Friends of Mammoth v. Board of Supervisors of Mono County (1972) that "an EIS must be prepared before any governmental entity – a state agency or regional or local body – approves a private project which could have a significant effect on the environment" (Council on Environmental Quality, 1974: 404). Michigan and Wisconsin ask for an impact statement for private actions that require a state permit, whereas Indiana

CLASSIFICATION OF STATES BY TYPE OF EIS REQUIREMENT, 1977

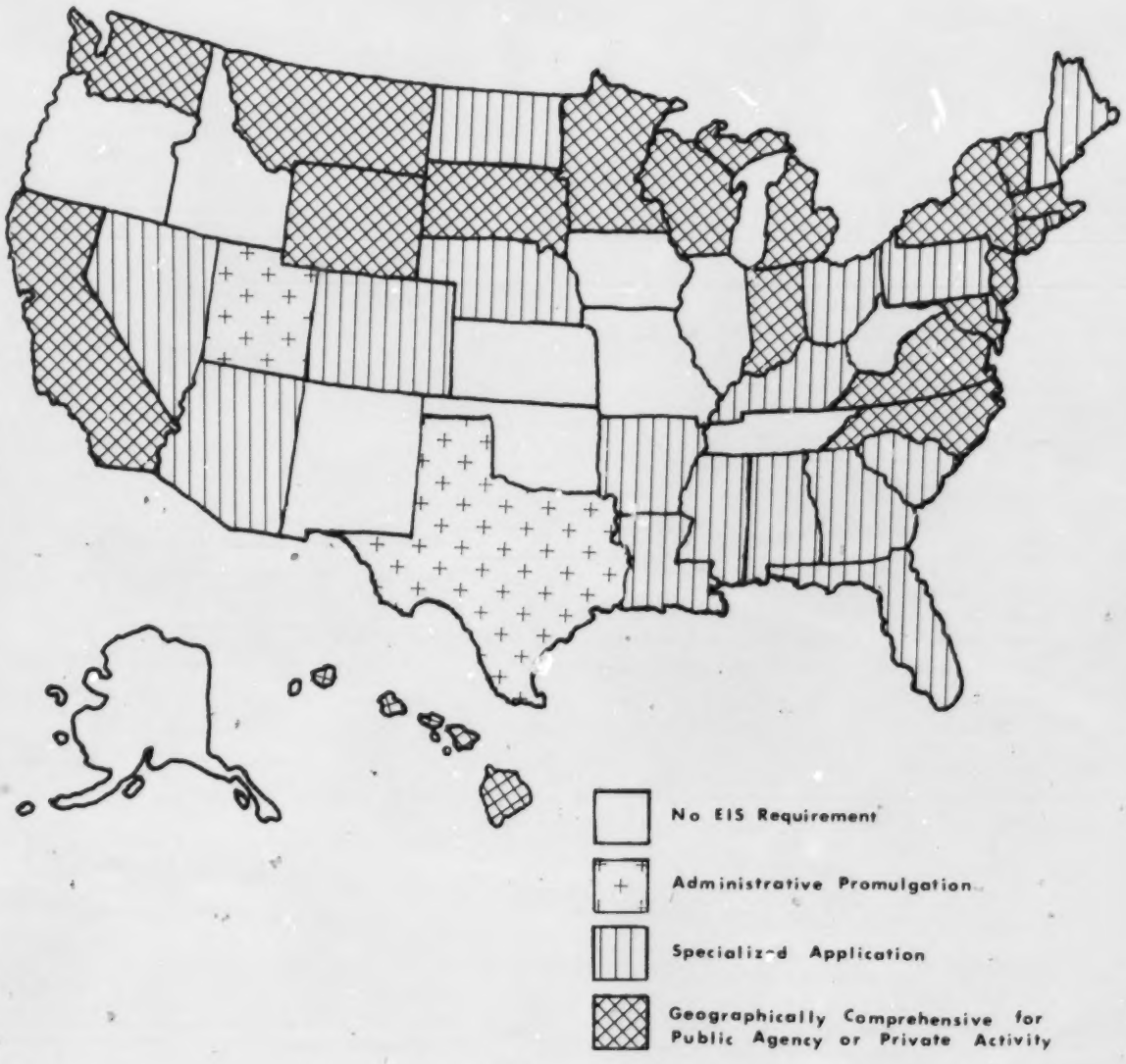

Figure 4. Source of Data: Burchell and Listokin, 1975.

specifically states that an EIS is not required for actions requiring the issuance of a license or permit by a state agency (Council on Environmental Quality, 1974: 404). Indiana limits the EIS to public actions undertaken by a state agency.

The administrative or the overseeing agency varies in accordance with legal authority. In general, if the agency's authority is statutory, it will usually have the power to grant or deny a development request. If the EIS is required via administratively promulgated regulation, the overseeing agency usually acts in an advisory capacity to the office of the Governor. These overseeing agencies vary by state. For instance, in California the responsible overseeing agency is the California Resource Agency; in Indiana it is the Environmental Management Board; in Montana it is the Environmental Quality Council. A detailed listing of responsible state agencies may be found in the updated edition of *The*

Environmental Impact Handbook (Burchell and Listokin, 1975: 14-36, see Exhibit 2-1).

As a general rule-of-thumb, Federal law will supersede state law when Congress explicitly expresses this to be the case and when the courts support this interpretation. NEPA is a Federal law intended to apply to Federal agencies and their activities. State laws fashioned after NEPA usually apply to state agencies or subdivisions of state government. Although there is no jurisdictional overlapping of the EIS reviewing process, the states are subject to the implications of Federal decision making policies. For example, the decision to grant or deny approval of an EIS prepared by the Army Corp of Engineers to construct a dam will have a direct impact on the state where the dam would be located. Since NEPA normally would preempt a state authority to make a final decision on such a project, the National Governor's Conference recommended to CEQ that states be notified earlier of the intention to prepare an EIS so the state can meaningfully participate and cooperate in coordinated preparation of the document (Council on Environmental Quality, 1976b: 135). Schmid (1978), however, argues that early notification is a false issue because agencies can involve other parties earlier through other processes.

Federal preemption may not be an important issue in the case of private project proposals. Private parties require local, state, and Federal approvals. Indeed, our own experience and Schmid (1978) suggest that private organizations fear state and local government hurdles more than the Federal barriers.

Full disclosure of major public agency activities is one of the conceptual underpinnings of the EIS process. The intent of full disclosure is to open public sector decision making to outside constructive criticism which would conceivably influence agency decision making. The specific role of public participation varies by state. Most state laws and administratively promulgated EIS requirements provide that copies of impact statements be made available to the public (Council on Environmental Quality, 1974: 406). The Wisconsin state law calls for notice of a hearing on a statement to be published in the affected area, and hearings are held on all impact statements. In Wisconsin an attempt is made to involve the public early in the process by having environmental groups assist in preparing the environmental assessments. In Minnesota public hearings are to be held on draft impact statements. On the other hand, North Carolina allows, but does not require, agencies to consult with the public (Council on Environmental Quality, 1974: 406). In short, different states have different opinions concerning the role of public participation. In order to determine the scope of that role, each law should be examined.

The EIS at the Local Government Scale

Since the passage of NEPA and subsequent environmental legislation by various states, the number of local municipalities requiring formal environmental review has increased. A listing of municipalities requiring such review may be found in *The Environmental Impact Handbook* (Burchell and Listokin, 1975). Local jurisdictions impose EIS requirements most frequently "through the established land use control mechanisms of zoning, subdivision control, and site plan review" and sporadically through "separate and distinct environmental ordinances" authorized by enabling legislation (Marra, 1977).

Most local EIS requirements are primarily directed at private development. The overseeing agencies are usually planning or zoning commissions, and in some cases an environmental commission. The reader should note that the environmental commissions may be purely advisory, whereas an environmental review component integrated into the planning and zoning commission functions may have legal authority to approve, deny, or request alteration in a development proposal.

Further generalization on the nature of local EIS requirements is not possible because the literature is presently limited. The local government EIS is a meaningful area for future research. We need more information on the number of EIS's prepared at the local level, whether or not they have been challenged in the courts, the character of the administrative process, and how they compare substantively to Section 102(2)(c) of NEPA. Another question is the extent to which states are influenced into passing environmental legislation as a result of their major urban centers instituting environmental policy, or as a result of neighboring states instituting environmental legislation. For example, New York City required the preparation of an EIS for certain activities well in advance of New York State's adoption of a similar practice in 1975. Rosenbaum (1976) suggests that geographical diffusion of state EIS legislation has occurred. In short, have local EIS requirements moved across the nation as waves, leapfrogged from major center to major center, or followed a random diffusion process?

Summary

All Federal agencies are to consider the environmental impact of their proposals. Because NEPA is written in such general language, the courts have played a key role in defining who may sue for compliance, what constitutes a "major" and a "significant" action, the adequacy of an EIS, delegation of EIS preparation, and "program" and "project" proposals. More than 8,500 EIS's have been submitted in response to Federal NEPA. Ten agencies have submitted more than ninety percent of the statements. The Department of Transportation has written more than 3,400.

State and local governments have written NEPA-like requirements. Some are legal documents, others are administrative requirements, and still others are informal modifications of existing practices. The only way to understand your community's impact assessment requirement is to read the appropriate documents.

III. HOW IS AN EIS REVIEWED?

The EIS review process varies when the specific EIS requirement is imposed at different governmental levels. We will limit our discussion in this chapter to NEPA – Section 102(2)(c). Nevertheless, the difficulties inherent in the internal process, the problem of document advocacy, and the overall problem of securing an unbiased review of the EIS are ubiquitous.

The preparation and review of an EIS was intended to be conducted with scientific objectivity. However, critics from public interest groups and governmental agencies have argued that the EIS preparation and review are merely a justification for actions which have been informally decided previous to the EIS review. This contravenes congressional intent to make the EIS a key decision making document. Although the courts have cautioned against rubber-stamp approvals, it is difficult to monitor all agencies' actions when thousands of statements a year are prepared and reviewed.

In addition to the rubber-stamp issue, another issue surfacing during the internal and external review stages of an EIS is interagency accommodation. Greenberg and Hordon (1974) note the great temptation for accommodation in order to "avoid any manifestation of internal agreements or disagreements with other agencies regarding impacts." They conclude that final decisions based on interagency accommodations will "probably not be the most desirable from the environmental perspective." Overall, rubber-stamping and accommodation are two generic EIS review problems.

Internal Review Process

The internal process is the review conducted by the agency proposing the project. It begins at the Federal level when an agency anticipates taking an action or instituting a program. The first question is: does this constitute a major action which will have a significant impact on the environment? The environmental official in the agency responsible for making such decisions will answer this question. The environmental officer usually acts in collaboration with agency administrators and staff and is also guided by legal interpretation which states that activities involving considerable time and planning and investment of financial resources should be reviewed. The officer may go outside the agency to other agencies with jurisdiction or special expertise in the specific field of activity for comment.

The following will illustrate the process by discussing briefly the method used by the USEPA. Although the procedures adapted by the EPA are not indicative of all other Federal and state agency review procedures, EPA's may serve as an illustration. The USEPA sponsors waste water treatment projects which involve Federal grants to local and county sewerage authorities. These are referred to as "201 grants" and involve a three-step process with each step linked to specific grants.

Before a sewerage authority is eligible for a grant, it must propose to construct or upgrade a facility to the state within which it is located. The state may or may not agree with the proposal, but if the proposal is accepted it is placed on a state priority list. Upon reaching a high priority, the state must certify the proposal so that the proposal may enter into the USEPA grant application stage.

After submitting an application to the USEPA, the sewerage authority is eligible for a step one grant. This is usually referred to as the facility planning phase. The sewerage authority will use the grant money to hire consultants who will develop a conceptual plan for the actual facility construction or upgrade based on a needs assessment also developed by the authority and consultants. At this point the applicant must prepare and submit to the USEPA an Environmental Assessment Statement (EAS). This is more or less a "mini-EIS" according to Ed Marra, Chief of the New York, New Jersey Environmental Impact Section, Region II, EPA. The EAS is a summary of possible and/or unavoidable impacts.

At least two groups in the Regional EPA office review the EAS – the engineering and environmental sections. The engineers review and comment on the conceptual design of the facility while the environmental group reviews the possible and/or unavoidable environmental impacts. Both groups comment on the needs assessment. If the conceptual design is approved, and the environmental group concludes that no significant impacts will result from the project, a negative declaration is written and the applicant may proceed to a step two grant.

The negative declaration is embodied in a short, one- to three-page letter. This accompanies the EAS, and is circulated to relevant Federal, state, and local agencies as well as to citizen groups and individuals on an EPA mailing list. On the other hand, if the EPA review concludes that significant impacts are likely to occur, it may require that a full-blown EIS be prepared. In this case, the EPA prepares the EIS, not the applicant. In lieu of a full-blown EIS, the applicant and the agency may negotiate certain project modifications that will avoid or eliminate adverse impacts to a substantial degree. Whether a negative declaration, negotiation, or full-blown EIS is determined as the appropriate method, the applicant then moves to the next step.

The step two grant is referred to as the design and engineering phase. The applicant must submit a step two application – again upon approval and certification by the state – to the USEPA. After receiving this grant, the applicant or its consulting agents develop the actual design and engineering specifications and construction parameters. Upon completion, they submit the plans to USEPA for review. The USEPA may find it necessary to negotiate modifications or require a full-blown EIS at this step, or at any step in the process, if environmental impacts are deemed significant. Even a previously determined negative declaration may now entail

the preparation of an EIS, but again, if this is determined, the USEPA prepares the document.

The step three grant or construction phase follows next. Actual ground-breaking occurs during this step. Previously unidentified problems may require that an EIS be prepared even at this late stage. Short of a full document, the applicant may be required to modify the project during the construction phase by the USEPA.

External Review Process

External is defined here as the review outside the agency proposing the project, in this case the USEPA. As previously mentioned, the USEPA circulates negative declarations to interested agencies, organizations, and individuals. Unless these outside reviewers point out glaring omissions or gross mistakes, the negative declaration usually is not modified.

When the EPA determines that an EIS document should be prepared, a number of internal/external activities occur. The specific guidelines are found in CEQ guidelines under 1500.9, 1500.10 and 1500.11 (38 *Federal Register,* August 1, 1973). First, a draft document is prepared by the USEPA and is circulated to other agencies and public reviewers for a period of forty-five days. During this period, the USEPA may hold public hearings and consider comments expressed at the hearings along with comments from the document reviewers. After the forty-five-day review period, the EPA can begin work on the final document. When completed, another thirty-day period for reviewers' comments and public hearings begins (Metzger, 1978). It is important to note that the CEQ guidelines state that the environmental official is obligated to seek out comments from Federal and Federal-State agencies with jurisdiction by law or special expertise with respect to the environmental impact involved [38 *Federal Register,* August 1, 1973, 1500.9(a)].

At the end of the thirty-day review period of the final EIS document, the responsible administrator may accept or reject the final document. The same administrator may or may not accept recommended alternatives, ways to avoid adverse impact, or mitigative measures. Legally, comments can be either incorporated or ignored. The administrator, however, may reopen the review process at any time during the project life to include or incorporate additional information. The administrator is not obligated to reopen the process, this is discretionary. An outside party may petition the administrator to reopen the review process. If this fails, the party must exhaust all administrative procedures, and then still has legal recourse.

There are at least two instances worth citing where the courts have been reluctant to reopen the review process. In Jicarilla Apache Tribe v. Morton (471 F.2d 1275, 9th Cir.; 1973) the court rejected the plaintiff's argument that an EIS was defective because important data were found after issuance of permits to construct coal-fired power plants. The court concluded that the future availability of relevant information does not render an EIS inadequate because such a holding would in effect put a moratorium on projects until all possible data were accumulated and reviewed. In Union of Concerned Scientists v. AEC (499 F.2d 1069; 6 ERC 1705; 1974) the court rejected the plaintiff's argument to review its decision based on 1972 cost-benefit ratios predicated on full-capacity operation, when subsequently it was determined that less than full-capacity operation was necessary. These cases point out the court's opinion that NEPA was not intended to require agencies to make long-range, speculative predictions.

This brings us back to the question of whether the EIS is really a tool to aid agencies in making informed decisions, or whether it is a *pro forma* document used to justify decisions made prior to objective investigation of impacts, and possible alternatives. Perhaps the intent of the law and the CEQ guidelines are undermined because "agency heads can for all practical purposes ignore environmental impact statements" (Odell, 1976: 5). Clearly, the EIS cannot receive appropriate attention if agency officials solidify decisions before gathering the facts.

The elaborate process used by the USEPA suggests that a serious effort is invested in a complicated system of checks and cross-checks among Federal, state, and local agencies, and other groups. But the USEPA is only one of many Federal agencies; frankly, many are not as interested in environmental impact as the USEPA. And even in the case where an agency wishes to follow sincerely the intent of Section 102(2)(c), is the EIS prepared early enough to be effective in shaping the final decision? Our experience with EIS process suggests that early involvement is necessary if constructive criticism is to be incorporated into proposal modifications.

A CEQ-sponsored study of NEPA identified another problem related to the review process. The study concluded that "a general complaint by Federal, state and local agencies and the public alike is that comments (on draft impact statements) do not elicit an adequate response from the initiating agency" (Odell, 1976: 7). Finally, there has been growing concern over the failure of Federal agencies that would be affected by an action to make any comments at all. This may perhaps be explained by the accommodation issue –the attempt to avoid interagency disagreements.

The USEPA is one agency that must comment on every Federal EIS. Section 309 of the Clean Air Act requires the USEPA, by appropriate region, to review all EIS's prepared by all Federal agencies. Although the USEPA staff can review and comment on the documents, they cannot demand modifications. This is not surprising since by law the agency chief of the office where the EIS is developed has the discretion to ignore comments. However, the USEPA staff may take issue with all or part of an impact statement, suggest modifications, and pass along pertinent information to other agencies which may grant or deny permits necessary for project approval (Marra, 1977; Metzger, 1977).

Each EIS reviewed by the Regional Offices of the USEPA is summarized (sometimes in a small abstract, but other times in greater length) and submitted for publication in the CEQ *102 Monitor.* Readers are urged

to scan some of these summaries to become acquainted with the types of projects proposed and their geographical/environmental character.

Review of the outside agency EIS's results in two formal responses. One concerns the environmental *sensitivity* of a project. EPA has three responses: (1) lack of objection – usually entails minor modifications; (2) environmental reservations – further study or substantive modifications are necessary; and (3) environmentally unsatisfactory. A second classification assesses the *adequacy* of the impact statement in the following three categories: (1) adequate; (2) insufficient information; and (3) inadequate.

These classification schemes have been criticized because they assume a consistency in rating, which is questionable given the large number of EIS's reviewed and the diversity of personnel responsible for evaluating them. In addition, the environmentally unsatisfactory and inadequate classifications are seldom imposed, rendering the trichotomous classes as actual dichotomies (Greenberg, Caruana, and Peterson, 1976).

Results of the Review Process at the Federal Scale

Evaluating the preparation and review process is difficult because the EIS concept has such broad implications for industry, bureaucracy, and society as a whole. With this caveat in mind, one means of judging the process is by evaluating major criticisms. The criticism most often heard about the EIS preparation and review process is that impact statement preparation and review requirements cause unnecessary red tape and costly project delays, especially when litigation occurs. In fiscal year 1975 alone, CEQ estimates that Federal agencies assessed over 30,000 actions with regard to environmental effects (Council on Environmental Quality, 1976b: 123).

In an effort to put this litigation/delay issue into perspective, the CEQ has contracted a survey of NEPA litigation (NEPALIT survey) experience by Federal agencies (Council on Environmental Quality, 1976b). The survey canvassed about seventy Federal agencies and determined that from 1970 to June 30, 1975 there were 654 court cases completed or pending where a NEPA issue was alleged. Of the 654 cases, 363 alleged that an impact statement was required but not prepared; and 291 cases alleged that the impact statement prepared was inadequate. By June 30, 1975, 332 cases were completed; only 60 temporary injunctions resulted, with only 4 permanent injunctions.

The survey has been updated to include cases up to June 30, 1976. The cumulative number of cases increased to 701, whereas the number of completed cases rose to 425. Of the 701 cases, about sixty-two percent alleged the failure of an agency to prepare a statement, whereas thirty-seven percent challenged the adequacy of a prepared statement. The number of temporary injunctions rose to 166, with only 71 delaying a project one year or more.

Although the NEPALIT survey does not cover all agencies, it does cover the most active (see Figure 1). The Department of Transportation had twenty-seven percent (or 181) of the litigated cases; HUD, seventeen percent (or 120); the Army Corps of Engineers, thirteen percent (or 93); and the Department of Agriculture, eleven percent (or 77). In order of magnitude, the following actions were most often challenged: (1) road construction projects – twenty percent; (2) urban renewal – nine percent; (3) dam construction – five percent; and (4) nuclear power – four percent. The remaining cases covered general and unique actions which are difficult to aggregate. Plaintiffs in the actions were the following: (1) citizen and environmental groups – sixty-five percent; (2) business and industry – fourteen percent; (3) local government – eleven percent; (4) state government – six percent; (5) unions – two percent; and (6) other – two percent. Overall, a typical litigated Federal case was brought by a citizen/environmental group alleging the Department of Transportation, HUD, or the Army Corps of Engineers had not prepared an EIS or had prepared an inadequate EIS.

The number of EIS's prepared by June 30, 1976 was approximately 7,364. The number of cases alleged was 701, about ten percent of the total number of statements prepared. Considering that sixty percent (or 425) of the cases were completed by that time, it appears that only four percent of the total number of projects remained delayed. At most, 71 cases were enjoined for one year or more – about one percent of all cases. From this perspective, it is difficult to justify the accusation that the requirement to prepare an impact statement necessarily leads to costly delays for actions. Indeed, one could argue that so few cases have been delayed or changed that NEPA is a waste of time for environmentalists. On the other hand, the few projects delayed may have been extremely important. A later section of the paper will review the strengths and weaknesses of the EIS process in greater detail.

Summary

EIS's under NEPA are reviewed internally and externally. The internal review consists of a decision as to whether the proposed action is important enough to warrant a full-blown EIS or a lesser document. The external review consists of examination of the EIS by other agencies.

The Federal review process has been criticized as nothing better than a "rubber stamp," as inducing unfavorable agency accommodations, and as a lengthy and wasteful mechanism. As of mid-1976, less than ten percent of all EIS's submitted under NEPA have been litigated. About one percent of the total have produced litigation delaying a project more than a year.

Whereas the Federal EIS process suffices to illustrate the difficulties of developing and reviewing EIS's, if you are interested in the process at the state and local scales, there is no alternative but to read the relevant documents. We know of no two processes that are exactly the same.

IV. HOW DO EIS REQUIREMENTS INTERACT WITH OTHER LAWS AND REGULATIONS?

By incorporating the impact statement requirement of Section 102(2)(c) into Federal agency decision making procedures, Congress intended each agency to fulfill the environmental protection and preservation policies set forth in NEPA. Section 103 of the Act and Executive Order 11514, Section 2.(d) require all agencies to review their statutory authority and determine any deficiencies which would prohibit full or partial compliance with the purposes and provisions of the Act. The deficiencies are to be corrected in order to make agency activities conform with the intent of NEPA. Further, in 1500.4 of the CEQ guidelines, agencies are directed to interpret " . . . the provisions of the act as a supplement to its existing authority." This same guideline qualifies the language of Section 102, which states "to the fullest extent possible" that agencies shall comply with the Act ". . . unless existing law applicable to the agency's operations expressly prohibits or makes compliance impossible."

The impact statement requirement applies to over seventy Federal agencies. As examples of the interaction of NEPA with other laws, the following brief subsections discuss the experience of the EPA with respect to the EIS requirement and other environmental laws, and the relationship between the EIS requirement and revenue sharing.

NEPA Interaction with Environmental Laws

The EPA has had an unusual relationship with the EIS requirement of NEPA. Before passage of the Act, the predecessor agency to the EPA employed an impact statement review process for grants for construction of sewage treatment facilities. After passage of the Act, EPA's activities with respect to the Clean Air Act and the Federal Insecticide, Fungicide and Rodenticide Act were challenged on the grounds that they were actions requiring the preparation of an EIS. The court concluded that EPA actions did not require an EIS since they already prepare a " 'functional equivalent' of an impact statement in the documentation supporting its actions" (Council on Environmental Quality, 1974: 388). Congress further exempted EPA from the impact statement requirement with regard to the 1972 Amendments to the Federal Water Pollution Control Act and the 1974 Energy Supply and Environmental Coordination Act. Even though the EPA was virtually exempt from the impact statement requirement, the agency declared that as of October 15, 1974 "it would voluntarily prepare impact statements on a variety of regulatory actions" such as "establishment of national ambient air quality standards, . . . sites for ocean dumping, and the cancellation of a pesticide registration" (Council on Environmental Quality, 1974: 388).

NEPA Interaction with Revenue Sharing

In general, state and local governments receiving and expending revenue sharing funds are not required to prepare an impact statement. The exclusion is explained in the nature of the revenue sharing program – Federal agencies are not involved with the expenditure of the funds. However, funds allocated as a community block grant under the Housing and Community Development Act of 1974 (HCDA) –a revenue sharing activity—may require the preparation of an impact statement [Section 104(h) of the HCDA]. The certifying official from HUD and the grant applicant waive any immunity to suit in Federal court to fulfill the obligations of NEPA (Council on Environmental Quality, June 1977: 31).

Overall, this brief section suggests that Federal regulations and laws are subject to NEPA. Ideally, the EIS process is an opportunity for a multiagency and multidisciplinary review of projects. The ideal has not been realized. Instead unique legal and administrative mechanisms have been devised for executing the interaction between the agency and NEPA. See Jack McCormick & Associates (1978) for a fuller discussion of NEPA's interaction with other laws and especially the effects of NEPA and related laws on the private sector.

V. HOW DO YOU PREPARE AN EIS?

An environmental impact statement should enable agencies and individuals reviewing the document to make a complete and balanced assessment of the potential impacts of the project being considered. Regardless of the degree of technical analysis, an educated lay person should be able to understand the conclusions and the reasoning which led to the conclusions of an EIS.

The method of preparation and the form of an EIS will vary as widely as the diverse projects that require EIS's. Current guidelines require all EIS's to address several generic topics. Although the wording varies by agency, the following six topics encompass the essence of EIS requirements.

1. Description of the Existing Environment
2. Description of Alternatives
3. Probable Impacts of Each Alternative
4. Identification of the Alternative Chosen and the Evaluation Which Led to Its Choice
5. Detailed Analysis of the Probable Impacts of the Proposal
6. Description of the Techniques Intended to Minimize the Adverse Impacts.

Organizing an EIS Project

A presentation of the six generic EIS topics constitutes the major part of this section. But first we will discuss the preplanning and coordination required for the preparation of an EIS, to start the reader thinking as soon as possible about the necessity of carefully organizing the research. Careful organization is crucial because, although the six topics must always be addressed, different projects require different details of analysis, different research teams, and different plans of action. Making an accurate and in many cases rapid assessment of the proper detail of analysis, research personnel needs, and a plan for developing and coordinating the analysis is in our experience a key to the ultimate utility of the EIS.

Wrong decisions have led to embarrassing and costly court confrontations, to long delays while studies are redone, and sometimes to the acceptance of projects that might otherwise have not been built or rejection of projects that would never have been proposed had the proper research design been developed. The senior author, for example, was involved in a case in which a $700 million project ultimately was rejected because the firm proposing the project (a nuclear power plant) had failed to research population projections. After an investment of $20 million over six years in the site and many thousands of dollars in impact statements, the company's proposed project was rejected by the agency on the grounds of excess population near the site. These adverse facts could have been discovered when the site was originally proposed had an appropriate research design been formulated.

The first part of this chapter has three main sections. We wil discuss briefly: (1) the breadth and depth of an impact statement; (2) the role of the multidisciplinary research team; and (3) the formulation of a research plan. The second part will describe in more detail the six generic EIS topics.

Generally, the breadth and depth of an analysis are determined by the specific proposal. Clearly a Federal office building or a 100-unit housing development should not require the same level of impact statement as the Alaska oil pipeline or a nuclear power plant. Because each project is unique, the level of detail in its impact statement must be based on its own characteristics. Some of the characteristics to be evaluated include (Barbaro and Cross, 1973):

(1) The geographic extent of the proposal (e.g., has an impact on one neighborhood; on an entire state)
(2) The potential future ramifications (e.g., local, short-term drainage problems; oil spill contaminating an important estuary)
(3) The generality versus specificity of the proposal (e.g., a general plant for housing renewal in a county; proposal to build utility lines along a specific corridor)
(4) The complexity of primary and secondary effects (e.g., new housing leading to better housing and some additional short-term construction jobs; petroleum refinery leading to possible water and air quality degradation, major addition of jobs and therefore people into the region, need for a hazardous waste recovery facility).

Although more extensive projects generally will require more extensive impact statements, one should not overlook the fact that even a small project may destroy a building of historical importance or a unique wildlife habitat. The finding of a site of historical importance or an endangered species has stopped projects (e.g., snail darter). Overall, the extent of research and information collection should, in some way, reflect the potential cost to society of the adverse impacts.

Specific projects and the environmental resources they use determine not only the overall dimensions of an impact statement but also the areas of emphasis within the statement. For example, in urban areas impacts on social, economic, and aesthetic conditions are likely to be crucial, whereas the impacts on the flora and fauna of an already significantly altered natural environment might be relatively small. A proposed dam would require greatly expanded sections on water quality and flooding. To summarize, an impact statement must be comprehensive enough not to miss any significant impact, and must identify the areas of greatest concern and concentrate on these areas.

Ideally, a multidisciplinary team should be used to plan projects. In the absence of such a group in project planning, a multidisciplinary team assembled to prepare

the impact statement is an effective means to ensure that the diverse aspects of a proposed project are noted, even if not incorporated. To put it another way, a multidisciplinary team will greatly reduce the possibility of overlooking important impacts. The fields of specialized training will depend on the particular project. Some of the most common areas to be covered, with their associated disciplines are (modified from Hopkins *et al.*, 1973):

Air—Meteorology, Bioclimatology, Acoustics
Land—Agriculture, Geography, Geology, Geomorphology, Soils, Urban Planning
Water—Water Resources, Hydrology, Limnology
Flora—Botany, Forestry, Ecology
Fauna—Wildlife Management, Zoology, Ecology
Humans—Anthropology, Economics, Geography, Sociology, Urban Planning, Architecture, Engineering

Once a team of people has been selected, a research plan must be prepared. A general outline for such a plan is (Lee, 1974):

1. Collect, review, and categorize available data
2. Decide on format of EIS and identify data gaps
3. Prepare project work program based on identified data gaps
4. Prepare preliminary version of EIS
5. Circulate preliminary version of EIS for internal review
6. Prepare draft EIS

Step three of this outline is vital. Data gathering is both time-consuming and expensive. It is difficult to determine how much detailed knowledge is necessary to assess adequately the potential impact on a particular aspect of the environment. Although the cost to society of collecting information may be greater than the potential cost of a wrong decision in case of small projects, decisions based on inadequate information can be terribly costly.

Several approaches have been suggested to aid in determining the necessary level of technical environmental assessment. Many of these are discussed in the section on probable impacts.

In summary, most EIS's require answering a set of standard questions. Whereas the questions are standard, the success achieved in addressing them depends upon the analysts' abilities to treat tersely all the impacts and distinguish succinctly among the unimportant and important.

The Six Generic EIS Topics

A description of the six generic EIS topics constitutes the major part of the chapter. Each of the following sections contains a review of the required topic and references that the reader may wish to consult. The references are exemplary rather than full representations of the literature. As you examine the topics, note that some items may not be relevant to every proposal.

Description of the Existing Environment

The General Location of the Proposal

The location must be established within the community, county, state, and the nearest metropolitan areas. A series of maps is generally required for this purpose. These maps should include the nearest roads, highways, airports, railroads, major recreation areas, and major centers of employment and shopping. These important features of the region should be identified because the project may have impacts on them. The maps also help orient the reader and will serve as references when the important issue of the impact region(s) is discussed.

References: Bryan, 1978; Bishop and Marsh, 1978; Hordon, 1976.

Land

Soils

Development can damage the soil. The soils must be described with the processes of erosion and sedimentation, mass wasting, and runoff in mind. The soil variables affecting these processes include texture, structure, permeability, bearing capacity, shrink-swell potential, depth to bedrock, rockiness, depth to water table, and presence of fragipans or duripans.

A detailed soil survey of the site should divide the site by soil categories. Using the soil variables, hydrologic soil group rates, or a soil loss equation together with other factors such as septic system limitations and agricultural potential, the suitability of the soils on the site for different uses should be evaluated. Prime farm land is especially noteworthy and may be specially protected by Federal, state, and local agencies.

References: Beasley, 1972; U.S. Department of Agriculture, 1971; Bartelli *et al.*, 1966; U.S. Federal Housing Administration, 1961; U.S. Department of Agriculture, 1960.

Topography

The general terrain and especially slope characteristics are essential in assessing possible soil erosion, mass wasting (landslides, soil creep, etc.), runoff from developed areas, and aesthetic considerations. The site should be categorized by the percent of land falling within selected slope categories. Many states have established slope categories which effectively prohibit development by restricting the installation of sewer pipes.

References: Marsh, 1978; Highway Research Board, 1958; Strahler, 1956; Wentworth, 1930.

Geology

The geology of an area affects and is in turn affected by different forms of development. Geologic conditions determine the likelihood of earthquakes, the ability to support large structures, the availablity of groundwater,

and the feasibility of installing underground water, sewerage, and natural gas utility lines. The effects of the planned release of sewage through septic systems or the impacts of accidental land spill of chemicals on groundwater will be determined largely by the geology of the area.

The following geological information is to be included: (1) bedrock type and characteristics (structural type and size); (2) surface geology; (3) mineral resources (sand, gravel, oil, etc.); (4) geologic cross-sections; (5) presence and characteristics of geologic faults in the area; (6) location of aquifers and their recharge areas; and (7) seismograph readings where appropriate.

References: Flawn, 1970; Baldwin and McGuinness, 1963; Todd, 1959.

Water

Surface Drainage

Information on rivers, lakes, marshes, and other water bodies, and on the land areas that drain into them is essential to assess the impacts of development on water resources. Topographic maps showing the drainage divides should be consulted. Maps should also be prepared showing the floodplain and floodway as designated by the U.S. Geological Survey in conjunction with the Federal Flood Insurance Program. The worst flood on record and the probability of floods of different magnitudes may also be included.

References: U.S. Office of the Federal Register, 1974; U.S. Department of Housing and Urban Development, 1973; Sorensen, 1971; Sewell, 1969; American Public Works Association, 1969; American Society of Civil Engineers, 1969; White, 1964.

Water Bodies

Information about all water bodies within the site and the drainage basin that includes the site must be included in an impact statement. Physical descriptors include length, total drainage area, surface area, volume, and seasonal variation of flow rate (cubic feet per second). Present uses of the water bodies might include water supply, effluent disposal, swimming, boating, fishing, and the aesthetic enjoyment of viewing bodies of water.

Water quality standards are directly related to the use of the water body and should be reported. Water quality data would include all available sampling results and would normally include the following parameters: (1) fecal coliforms; (2) turbidity; (3) dissolved oxygen (DO); (4) biological oxygen demand (BOD); (5) inorganic carbon; (6) nitrate nitrogen; (7) total phosphates; (8) pH; (9) temperature; and (10) toxic substances. Once potential adverse impacts of the proposal are known, additional predevelopment water quality data may be required. Particular attention should be directed to any water quality parameter that exceeds or approaches the level of a standard or is a toxic or hazardous substance.

References: Izaac Walton League, 1973; Velz, 1973; Grava, 1969; Swenson and Baldwin, 1965.

Air

Climate and Meteorology

Knowledge of the climatology and meteorology of an area is required in order to assess potential air emission and water resources impacts. Important information includes precipitation, temperature, prevailing winds, the extent of inversions, average morning and afternoon mixing heights, and the occurrence of storms of particular intensities and durations. Special attention should be given to unusual conditions such as tornadoes, hurricanes, extreme fog, temperature inversions, and extreme high or low temperatures. These factors not only have a direct impact on the area of the proposed development but are essential to understanding the dispersion and removal processes of pollutants in the atmosphere.

References: Epstein, 1974; Beals, 1971; Gifford, 1961; Landsberg, 1956; Trewartha, 1954.

Air Quality

Very poor air quality may preclude certain forms of development from a site, and certain forms of development may cause air quality to fall below established standards. An impact statement must include data on the past and present air quality of the region and especially draw from the air quality monitoring stations nearest the proposal site. These data should be compared with national and state air quality standards for the following pollutants: (1) total suspended particulates (TSP); (2) sulfur dioxide; (3) carbon monoxide; (4) photochemical oxidants; and (5) nitrogen dioxide. Pollutants that exceed the standard for daily average, eight-hour average, or maximum concentration must be identified. The major sources of air pollution in the area (automobiles, industry, power plants, residences, etc.) should be identified. Evidence of air pollution such as tree, crop, or livestock damage should be recorded.

References: U.S. EPA, 1976; Epstein *et al.*, 1974; Hesketh, 1974; U.S. EPA, 1974; Brodine, 1973; Hanna, 1971.

Noise

Where loud sounds occur, noise can be a serious pollutant. The background noise and a survey of noise-producing activities and noise sensitive areas in the vicinity of the proposal site should be made. The background noise, known as the ambient sound level, can best be found by sampling with a sound level meter measuring decibels with an "A" weighting. Measurements should be taken at several times during a day to determine typical noise levels at busy and quiet periods of the day and night. Measurements should be taken near noise-producing activities such as highways, industrial areas, commercial districts, and near noise sensitive areas, such as hospitals, schools, libraries,

residential areas, and recreation areas. State and Federal EPA and HUD noise officials should be contacted to find how noise regulations and guidelines compare with the ambient noise at the site.

References: Bragdon, 1971; Peterson and Gross, 1963; Large and Ludlow, 1976; LaBreche *et al.*, 1976.

Odor

Although not easily quantified, strong odors are a serious environmental pollutant. Any sources of strong odors near the proposal site should be described.

References: Johnston and Moulton, 1974; Summer, 1971; Cox, 1975; Harper, 1968; Copley International Corporation, 1970-73.

Biological Resources

The fauna and flora of an area interact in many complex ways. The concept that the animal life on the top of the food chain in an area is dependent on the plant species at the base of the food chain is accurate, but does not convey the intricate relationships and delicate balance of an ecosystem. The level of detail varies, but some description of the wildlife and vegetation of the proposal site is required in an impact statement.

The communities of vegetation in and surrounding the proposal site should be described and mapped. Since humans have previously altered many areas, the history of the site's plant communities and their stages of ecological succession is often important.

Various animal species are associated with a community of vegetation. An impact statement should describe the wildlife present and give some estimate of the numbers of the species. Information on the size of required habitat should be included for each species, along with the habitat area presently available.

Particular attention should be given to any unique, rare, or specially fragile vegetation and endangered wildlife. Communities that have conducted natural resources inventories as part of their master zoning plans may have this information readily available. In other areas local botanical societies, universities, museums, nature associations, and wildlife groups like the Audubon Society are usually very helpful. State departments of natural resources or environmental protection often have some of this information and usually know of other sources of local information.

References: Grossa *et al.*, 1978; Moen, 1973; Odum, 1971; Teague, 1971; Billings, 1968; Phillips, 1959; Oosting, 1956.

Human Settlements

Physical Infrastructure

The physical infrastructure in the vicinity of the proposal site is an important component of an impact statement. The ability of the local political entity (municipality, county, or special district) to provide services affects the types of development that can take place. Any development always has impacts on the infrastructure.

References: U.S. Censuses of Population, Housing, Manufacturing, and Business (appropriate years).

Transportation Systems

Information should be collected on all existing transportation facilities in the region. The locations of all roads, airports, railroads, mass transit, canals, etc. should be mapped. The condition, present types of use, speed limit, congestion areas, and traffic and usage counts should be collected for these facilities.

References: Schott, 1977; Organization for Economic Cooperation and Development, 1976; Nelson, 1975; Federal Highway Administration, 1974; Oi and Shuldiner, 1962; Highway Research Board, 1960; U.S. Department of Transportation, 1975.

Public Water System

The sources, treatment facilities, and distribution network should be described. The estimated safe yield of the source and any unused capacity of the treatment facilities should be recorded. Information on the age and condition of the facilities and the pipes in the distribution system should be collected.

References: Greenberg and Hordon, 1976; Whitford, 1970; Linaweaver *et al.*, 1967; Fair, Geyer, and Okun, 1966.

Sewer and Waste Water Treatment System

The age, condition, and quantity of unused capacity of the system should be described. The history of compliance with state standards should be discussed. Any plans for the expansion or upgrading of facilities should be included in this section. This information will be available from the local planning agency established under Section 208 of the 1972 amendments to the Federal Water Pollution Control Act. A map of the interceptor system showing the proposed site and the nearest point of connection to the system should be included in this section.

References: Fair, Geyer, and Okun, 1966.

Solid Waste Management System

The method of solid waste disposal should be described. The methods of collection, treatment, and disposal along with the costs of these components of the solid waste management system are important information. The unused capacity and expected life of the present disposal facility are also important to an evaluation of the existing infrastructure.

References: Greenberg *et al.*, 1976; Office of Solid Waste Management, 1976.

Energy System

All suppliers of electricity, oil, natural gas, and coal

should be listed along with the information concerning their ability to supply additional customers. Evidence of blackouts, brownouts, and unavailability of supplies should be described.

Other aspects of infrastructure present in the vicinity of the proposal site should be described in the same manner. These might include: schools, recreation facilities, police protection, fire protection, libraries, etc.

References: Cook, 1977.

Economic Infrastructure

Community and area employment and unemployment levels and trends should be discussed. The major types of employment available and their respective levels and trends should be included in the economic analysis. Major regional industrial and commercial facilities serving the area and any planned for the area should be described.

References: McEvoy and Dietz, 1977.

Socioeconomic Structure

A general description of the socioeconomic characteristics of a community is best attained by collecting statistics on selected variables. The U.S. Census almost always suffices as a source of these data. These include: (1) income; (2) occupation; (3) racial and ethnic composition; (4) education; and (5) age structure. These variables will be viewed in the context of the proposed project's potential to change the existing region's characteristics.

References: Dietz, 1977; Burdge and Johnson, 1977.

Aesthetic Environment

The general aesthetic features and features unique to the area should be included. The general features would include descriptions of the overall natural landscape and the patterns and architectural styles of the existing structure. Unique features might include a ridge with a scenic view, a beautiful setting for a lake, or historic and archaeological sites or buildings. Photographs and maps are a good accompaniment to the description because they can convey unique information or information in a unique way.

References: Burnham, 1974; Litton, 1973; Redding, 1973; Hughes, 1972; Ullman, Dacey, and Brodsky, 1969.

Local Government Structure

The ability of local governments to control development through various land-use control mechanisms should be described.

Reference: Platt, 1976.

Description of Alternatives

An outline of alternatives to the proposed project is an important part of an EIS. Many EIS's have been rejected because alternatives were not developed. Alternatives should be developed as part of the decision making process to help select the best proposal. The alternatives are also of value to reviewing agencies whose long-range plans may be more in harmony with some alternatives than with others.

Status Quo

One option that must always be considered is that of not undertaking any project at all at a particular time. The proposed development site has some value in its present form, whether that be high-intensity use or natural open space. In addition to the value of its present use, the *status quo* option preserves the proposed site for future development with high potential value for society.

Engineering Alternatives

Changes in the engineering aspects of a project often produce alternatives with strikingly different beneficial and adverse impacts. For instance, power plants may be nuclear powered, oil burning, or oil plus recycled waste burning. The significantly different engineering options should be developed and evaluated as alternative proposals for development.

Design Alternatives

Design alternatives of a project always produce different impacts on the aesthetic environment. In some projects design changes produce different impacts in many other areas.

Location Alternatives

A proposed project will usually have alternative locations available. These may be already owned by the proposing entity, or available on the real estate market.

Probable Impact of Each Alternative

The beneficial and adverse impacts of each alternative can be determined by comparing the expected future conditions with existing conditions. Each aspect of the existing environment described above would be compared to the probable environment if each alternative was chosen. This information is important to an EIS to ensure that feasible alternatives are chosen and to distinguish impacts of the proposed project inherent in the nature of the project from those that result from the particular alternative selected.

Analysis Devices

Checklists and evaluative devices have been

developed to help the analyst identify and weigh the relative importance of different impacts. This section will briefly review some of these impact methods.

The simplest methods contain a list of attributes and processes that should be considered. For example, the following should always be considered when studying wildlife: (1) barriers and corridors; (2) benthic organisms; (3) birds; (4) endangered species; (5) fish and shellfish; (6) human health; (7) insects; (8) land animals; and (9) microfauna.

More sophisticated checklists ask specific questions, contain impacts likely to result from a type of development, and suggest impact weights. As an illustration of a question approach, the first question from the senior author's industrial environmental impact checklist (Greenberg, 1978) is reproduced below:

1. Will discharges directly from the facility be different from the conditions of the ambient environment? The question focuses on air quality. It points the analyst to the proposed plant's process and fuel emissions.

Most checklists stop with a single tier of questions. Others present a second level of questions. Our industrial impact checklist has a second tier. On the one hand, if the answers to the first questions are no, then the analyst need not be concerned with those specific impacts. On the other hand, if the answer to any of the first set of questions is yes, then a set of follow-up questions is available.

1a. Will the discharges lead to the violation of an air quality standard in the case of carbon monoxide, nonmethane hydrocarbons, nitrogen dioxide, photochemical oxidants, particulate matter, sulfur dioxide?

1b. Will the discharges include the following: toxic organics, toxic inorganics? If the plant emits particulates or gases different from concentrations of the ambient environment (checklist question 1), the questions 1a and 1b tell the user to determine if the emissions will lead to an air quality standard violation or if the emissions include toxic materials. If the answers to questions 1a or 1b are yes, then the project is going to produce a serious negative impact that must be investigated in great detail.

Beyond the relatively simple checklist models overviewed above are more sophisticated approaches that may conveniently be trichotomized: (1) matrix association models; (2) index models; and (3) computerized evaluation models. Each of these will be outlined briefly, with one example discussed as representative. The matrix association models (Leopold *et al.*, 1971; Sorensen, 1971; Toth, 1968) compare types of proposed developments with types of environmental characteristics. The user assigns values to the impact of the development on the environment. The impact numbers are compared to the "no action" numbers.

The Leopold and associates (1971) model will be reviewed briefly, because it is the most readily available. This association matrix contains a set of 88 environmental characteristics on the vertical axis. These characteristics are in five broad categories: physical and chemical characteristics, biological conditions, cultural factors, ecological relationships, and others. The horizontal axis has 100 proposed actions that may cause environmental damage. These are in eleven major groups: modification of regime, land transformation and construction, resource extraction, processing, land alteration, resource renewal, changes in traffic, waste emplacement and treatment, chemical treatment, accidents, and others. A small piece of the matrix is reproduced below (Figure 5). The sample matrix contains 182 impact boxes (13 proposed actions x 14 environmental characteristics). The full matrix includes 8,800 boxes. The impacts can be rated from 1 to 10, with negative and positive signs used to indicate negative and positive impacts. Depending upon the type and complexity of the project, different parts of the matrix would be emphasized.

The important strengths of this approach are that the magnitude and importance of impacts may be distinguished and the matrix is an excellent format for summarizing results and presenting impacts. The major disadvantages of the Leopold Association Matrix is the subjectivity of the -10 to $+10$ ratings. Different evaluators derive different ratings. Other weaknesses are a lack of concern for social impacts and some overlapping project and environmental categories (Warner, 1973).

The index models (Dee *et al.*, 1973; Battelle, Columbus Labs, 1973; Stover, 1972; Zieman *et al.*, 1971) provide checklists and preassigned quantitative impact values. Weights are assigned to individual and groups of impacts. The Battelle method will be used as an illustration.

In the words of the staff, Battelle's environmental evaluations system (EES) "was designed to be comprehensive, systematic, interdisciplinary, and pragmatic" (Dee *et al.*, 1973). Results include total impact scores ("environmental impact units") with and without the proposed project and with and without alternative projects and the isolation of major adverse impacts ("red flags"). All results are in quantitative form and are amenable to validation by other groups, and to a variety of sensitivity tests of the relative importance of particular parameters.

Because the results from quantitative modelling analyses are only as good as the input data, it is important to consider in some depth the information used in the environmental assessment model. The Battelle method includes four major categories of information: ecology, physical/chemical, aesthetics, and social. The four categories include nineteen components, and the nineteen components include sixty-four parameters. Each of the nineteen components is assigned an importance index which is a proportion of 100.

The heart and one of the most controversial parts of the Battelle approach is their method of scaling the parameters so that they are commensurate. The scientist, planner, and engineer who have been modelling the impact of different discharges on the environment may view the Battelle scaling method as a gruesome travesty of science; conversely, the scientist and citizen will necessarily sacrifice some detail about the physical environment in order to include aesthetic and social considerations that may be used to counter benefit/cost economic arguments.

A PORTION OF LEOPOLD ASSOCIATION MATRIX

INSTRUCTIONS

1- Identify all actions (located across the top of the matrix) that are part of the proposed project.

2- Under each of the proposed actions, place a slash at the intersection with each item on the side of the matrix if an impact is possible.

3- Having completed the matrix, in the upper left-hand corner of each box with a slash, place a number from 1 to 10 which indicates the MAGNITUDE of the possible impact; 10 represents the greatest magnitude of impact and 1, the least, (no zeroes). Before each number place + if the impact would be beneficial. In the lower right-hand corner of the box place a number from 1 to 10 which indicates the IMPORTANCE of the possible impact (e. g. regional vs. local); 10 represents the greatest importance and 1, the least (no zeroes).

4- The text which accompanies the matrix should be a discussion of the significant impacts, those columns and rows with large numbers of boxes marked and individual boxes with the larger numbers.

SAMPLE MATRIX

	a	b	c	d	e
a		+2/1			+5/5
b		+7/2	+8/8	+3/1	+9/7

A MODIFICATION OF REGIME

a Exotic flora or fauna introduction
b Biological controls
c Modification of habitat
d Alteration of ground cover
e Alteration of ground water hydrology
f Alteration of drainage
g River control and flow modification
h Canalization
i Irrigation
j Weather modification
k Burning
l Surface or paving
m Noise and vibration

PROPOSED ACTIONS

PHYSICAL AND CHEMICAL CHARACTERISTICS

1 EARTH
- a Mineral resources
- b Construction material
- c Soils
- d Land form
- e Force fields and background radiation
- f Unique physical features

2 WATER
- a Surface
- b Ocean
- c Underground
- d Quality
- e Temperature
- f Recharge
- g Snow, ice, and permafrost

Figure 5. Source: Leopold, Clarke, Hanshaw, and Balsley, 1971.

The Battelle scaling approach should be considered in the context of alternative approaches. The simplest and usually the most unsatisfactory approach is to describe the impacts. Verbal remarks may be erudite and incisive; however, more typically they are not incisive, not systematic, and not comprehensive. A second approach is to rate the impacts along a scale such as critical, average, or not important. A simple rating scheme is better than a purely verbal description but falls short of providing commensurable results. At the other extreme,

mathematical water quality models may be used to simulate the impact of a discharge of an oxygen-demanding waste on water quality with a high degree of accuracy.

The Battelle scaling procedure falls between the qualitative judgment and the mathematical modelling approaches. A 0 to 1 index is developed for each parameter, where 1 indicates the best environmental quality and 0 indicates the worst environmental quality. These indices sacrifice information about the ecological and physical/chemical parameters and perhaps impose a quantitative structure on the aesthetic and social components.

The compromises in constructing the indices may be illustrated by reviewing two of the more controversial indices: (1) physical/chemical: dissolved oxygen, and (2) biota: wooded shoreline. Dissolved oxygen (DO) is the most commonly used indicator of water quality. Typically, the higher the DO, the smaller the discharge of organic and other wastes into the water body and the better the water for recreation and for the maintenance of a heterogeneous aquatic population. Low DO values hamper the reproduction, feeding, and ultimately the respiration capabilities of fish and benthic organisms. Rivers with low dissolved oxygen have a limited number and variety of pollution tolerant species (e.g., eel, pike) and are normally classified as unfit for contact recreation. If dissolved oxygen is absent from a water body, anaerobic decay will occur and produce an unpleasant odor.

DO is measured in milligrams of oxygen per liter of water (mg/L) or parts per million (ppm). The critical range for DO is 2-6 ppm. Battelle casts the DO continuum from 0 to 14.6 ppm into four ranges (Table 2). We would argue that the break should have been made at 3 and 6 ppm instead of at 2 and 5 ppm because at DO levels below 3 ppm many species are seriously hindered. DO levels above 7 ppm act as a buffer against shock effluent loads. The important conclusion to be drawn from this brief consideration of DO is that Battelle's grouping of DO into four ranges involves a loss of information about the impact of small changes in DO on the river ecosystem.

TABLE 2. BATTELLE DISSOLVED OXYGEN INDEX

Range	Parameter Measurement (ppm)	Parameter Quality Index
1	$0 \leq DO \leq 2$	0.0
2	$2 < DO \leq 5$	0.2
3	$5 < DO \leq 7$	0.7
4	$7 < DO$	1.0

Source: Dee *et al.*, 1973: 76.

The biota: wooded shoreline parameter implies the converse problem of imposing a quantitative structure on aesthetic preferences. The wooded shoreline parameter is based on the assumption that a shoreline bordered by trees and shrubs is more pleasing than one not bordered by shrubs and trees. The four ranges and associated parameter quality values are listed in Table 3. In this case one can dispute the parameter quality index and the overriding assumption that a clearly defined shoreline is more pleasing to persons from non-wooded areas who do not share the tree bias brought from Europe by the early American settlers.

Most of the other sixty-two parameters fall between DO and wooded shoreline with respect to the noise generated and information lost by casting them into ranges. Overall, although one can dispute the method of structuring the parameters, one cannot dispute the fact that the standardization of all the parameters makes the model easy to understand and to replicate.

One of the other characteristics of the Battelle model will be reviewed briefly. Major impacts ("red flags") are defined by a change of two ranges. For example, in the DO case (see Table 2), if a proposed outfall could reduce DO from range 4 ($7 < DO$) to range 2 ($2 < DO \leq 5$), the project should be seriously considered for modification or rejection unless there is an overriding compensating feature.

TABLE 3. BATTELLE WOODED SHORELINE INDEX

Range	Parameter Measurement	Parameter Quality Index
1	no trees	0.0
2	some trees	0.5
3	half trees	0.8
4	predominantly trees	1.0

Source: Dee *et al.*, 1973: 113.

In summary, the use of ranges for parameters and "red flags" to define critical impacts clearly simplifies the job of the analyst, allows the work to be evaluated by persons who are not specialists, and tends to assure consideration of some impacts that otherwise might have been neglected because of a reluctance to mix qualitative and quantitative information. The major limitations include the fact that it was designed only for water resources studies (therefore the weights are biased towards water resources impacts), forces all forms of information into a similar form, and evaluates impact components independently of their potential induced effect upon other components. The index models approach is also subjective. However, the subjectivity is on the part of the model developers, not the user.

Computer models have taken a number of routes (Krauskopf and Bunde, 1972; Department of Parks and Recreation, California, 1966a/and 1966b; Steinitz and Sinton, 1969a and 1969b; Fabos and Caswell, 1977). The major approach follows the work of McHarg (1969) on land suitability mapping. Natural resource inventory data are organized by grid cells. The data (e.g., soil, groundwater, vegetation) are assigned importance weights. The

weights are compared or added, yielding suitability scores for different grids. Then proposed projects are evaluated according to their potential impact on the values. Mathematical simulation models are often used in the process to measure the impact of the proposed project on the environment.

The strength of the computerized approach is the capability of rapidly displaying, overlaying, adding, and testing massive amounts of data. Some of the models are interactive. The user can communicate with the computer through a cathode ray tube, change values, and immediately see different results. Disadvantages are that subjectivity remains, the demands for data are enormous, the models are costly to build, and the user must either read through a lengthy manual describing the model assumptions or take a good deal on faith. For example, the authors designed and tested a computerized model that calculated air emissions resulting from different types of housing developments. The user was able to choose among three dwelling unit types, three different fu[illegible] and per capita automobile mileage estimates. [illegible]ombinations yield air emissions estimates. This simple part of one computerized environmental impact model was costly to program and in order to ask questions about the model assumptions, users had to read a document of over fifty pages.

More recent computerized economic/environmental models such as SEAS (Strategic Environmental Assessment System) (Lakshmanan and Chatterjee, 1977), SOS (Williams and House, 1974), and DEROCS (Marcus *et al.*, 1977) severely stretch the ability of the analyst to develop and test the scientific theories and the data for the model. In addition these models require of the user a level of technical preparation possessed by few people.

Many professionals look askance at the more sophisticated evaluative methods. For example, as part of a year-long interdisciplinary seminar, twenty-five engineers, chemists, biologists, architects, lawyers, and geologists sought means of measuring and displaying environmental impacts (Ortolano *et al.*, 1973). The seminar members concluded that "the complexity of the assessment task, and the diversity of situations in which it must be accomplished, preclude 'cookbook' or detailed programmed type methodology." Rather they argue that the specific project being considered and the requirements of the user will determine the most appropriate methodology. In certain situations different aspects of an impact statement may require different techniques. For example, the National Forest Service is using a three tier approach that divides a project into three levels of assessment. The first tier addresses broad policy questions concerning renewable resource programs. The second tier addresses overall land-use decisions for large units of national forest (20,000 to 200,000 acres). The third tier addresses specific sites, dealing with where trees are cut, roads built, or herbicides used (Conservation Foundation, 1976). In this example each tier would have a different level of technical environmental assessment and perhaps a different methodology.

Procedures and handbooks are being developed to address specific impacts such as highways (Federal Highway Administration, 1974; Sauerlender, 1972), airports (Nelson, 1975; Organization for Economic Cooperation and Development, 1975); utility lines (Smith, 1976; Holberger, 1975), and many others.

Overall, the matrix association, index, and computerized evaluation models help clarify and measure the key environmental impacts of a proposed project and point the user toward the enormous complexity of environmental impacts. The major weakness is that they tend to drive the user's attention toward identifying and measuring impacts as opposed to interpreting impacts and communicating them to impact statement readers. In addition, most ignore the need to monitor impacts beyond the preparation of the report and do not treat adequately the secondary effects of projects and interrelationships of impacts. They tend to present impacts as separable and unrelated to one another.

To summarize, there are no agreed-upon methods for EIS work. Perhaps the most realistic statement about EIS methods was offered by Schmid (1978), who suggested that many EIS projects require advances in the state of scientific knowledge that are difficult if not impossible to accomplish within the time and budget available for the EIS.

Probable Impacts of Each Alternative

Probable Adverse Impacts

Having isolated the impacts, the adverse impacts are presented. The most significant (worst) adverse impacts should be listed first, but generally are not except in the summary section.

Probable Beneficial Impacts

It is important to compare the benefits of each alternative. The EIS must also state to whom the benefit accrues, along with the recipients of adverse impacts. Benefits may be to individuals, neighborhoods, or a nation, or may be international; adverse effects may be felt by the same or other entities.

Probable Construction Period Impacts

The environmental impacts of a project during its construction should be described within a section of their own. The economic impacts are substantial. Construction employees, construction materials purchased, and equipment and supplies to outfit the project all have a direct impact on the economic base of the local and regional political units. Each of these activities stimulates indirect or multiplier effects which must also be considered.

Probable Short-Term Impacts

Effects of the project that extend beyond the end of construction but for only a short period of time are short-term impacts. After construction there is often a short-term adverse impact on water quality until vegeta-

tion has grown enough to hold the soil in place. Large public works projects often have substantial short-term beneficial impacts on a community because of the multiplier effects of the large expenditures for employment and construction supplies. Although these impacts often make benefit/cost analyses appear favorable, the impacts are often only short-term.

Probable Long-Term Effects

The effects of a project fifteen years after it is constructed may be significantly different from its short-term effects. This significant difference may be either negative or positive depending on the project. Some projects, dams for example, have great short-term impacts, but after construction ends have little or no direct economic impact on the community. In fact, the local economy, which grew rapidly during construction, and the many new residents may cause negative impacts in the long term. Projects that bring permanent employment into the community may have positive cumulative impacts. However, the community's identity will not survive, unless the socioeconomic characteristics of the community and the new employment opportunities are complementary.

Irreversible or Irretrievable Commitments

The implementation of the proposed project may use finite resources in such a way that they may never be used again. An irreversible use of resources is one in which the resource cannot be fully restored physically. An example would be prime agricultural land that is strip-mined. An irretrievable use of resources is one in which some of the resources may still be physically available, but are not economically retrievable. An example would be the physical infrastructure (sewers, water, gas, etc.) to support a project. Both irreversible and irretrievable commitments of resources should be described for both direct and indirect effects.

This section should focus on the use of resources and their magnitude, rather than just on impacts on the environment. This section should not merely repeat impacts already discussed.

References: Hopkins *et al.*, 1973.

The long-term, irreversible, and irretrievable impacts of a small housing project are likely to be of limited importance beyond the community. Other proposed projects are so important to a region as to warrant carefully considered treatments. For example, the character of the New Jersey Atlantic Coast might be irreversibly changed by some of the energy related projects that have been proposed during the 1970's. These projects include nuclear electricity generating stations in the ocean, liquified natural gas plants, offshore oil exploration and, presumably, production, and deepwater oil terminals. The last of these will be reviewed briefly to illustrate the type of proposed project requiring an extremely thorough review.

A deepwater terminal facility would consist of a monobuoy floating in the Atlantic Ocean, perhaps an artificial island with storage tanks, and a pipeline capable of serving very large crude oil carriers. One of the favored onshore options of a deepwater terminal is the development of new petrochemical complexes. In the New Jersey case, the firm of Arthur D. Little, Inc. (1973) analyzed the environmental impact of a deepwater terminal tied to petrochemical complexes in the United States. One of the options studied was a 1.9 million barrel per day refinery complex on the southern tip of New Jersey, in Cape May and Cumberland Counties. The impact of the proposed refinery on these two rural counties would be monumental (Table 4).

In the absence of the refinery, the two counties are projected to slightly more than double their employment and population. If the refinery complexes are built, population and employment would be expected to more than quadruple by the year 2000. Total personal income, property taxes, water withdrawal, and the discharge of oxygen demanding wastes would increase more than ten times. Developed land would increase from only twenty percent to almost sixty percent of the total. In short, under the scenarios considered by Arthur D. Little, Inc., Cape May and Cumberland Counties would be irreversibly converted from rural agricultural and resort areas to urban industrial communities. Clearly, such a powerful change should warrant the most reasoned judgments in an EIS.

Alternatives to be considered include a change in the population's oil consuming habits, alternative sources of crude oil or substitutes, and the selection of another site or sites. Overall, in the case of major projects this section of the EIS should consider that a proposed project may bring economic and political power to a region and benefit the national economy but may also lead to congestion, environmental degradation, suburban sprawl, and the elimination of open space. Geographers should be particularly interested in the spatial justice implications of major projects like oil terminals, petroleum refineries, iron and steel plants, and many others (e.g., Carey and Greenberg, 1974).

Identification of the Alternative Chosen and the Evaluation Which Led to Its Choice

Having described the alternatives and their impacts, it is now appropriate to select the best option. The reasoning behind the choice should be described and supported by references to the specifics of analysis from the earlier sections of the impact statement.

Although many factors in the decision will be based on facts or clearly defined projections, others will be subjective and must be clearly stated as such. Runoff may be a critical factor, and one alternative will produce less runoff than another possible alternative based on clearly defined runoff prediction criteria. Comparing the benefits of a proposed action with the potential negative impact of adversely changing the character of the community is not so clear. The evaluation of this tradeoff is subjective, and the EIS must clearly identify the evaluation as such, and present both contending arguments. The person or agency reviewing the EIS

TABLE 4. ESTIMATED IMPACTS OF DEEPWATER OIL TERMINAL ON CAPE MAY/CUMBERLAND COUNTY AREAS

Category	Delaware Deepwater Terminal Cumberland/Cape May New Jersey High Option		
ECONOMIC	1970	2000 Baseline	Total
Refinery Capacity (thousand barrel/day)	0	---	1900
Total Employment (1000's)	68	150	300
Population (1000's)	181	400	800
Total Personal Income (millions 1970 dollars)	580	2230	5400
Per Capita Income (dollars)	3205	5575	6750
Property Tax Revenues (millions 1970 dollars)	44	175	410
ENVIRONMENT			
Groundwater Withdrawn Total (mgd)	55	150	635
Biochemical Oxygen Demand (BOD) Discharges (1000's lbs/day)	15	65	175
Developed Land (% of total land)	20	34	58

Source: A.D. Little, Inc.

should be made aware of both the factual and the subjective criteria by which the proposed project is selected from the alternatives.

Detailed Analysis of the Probable Impact of the Proposal

Having selected the best alternative, the probable impacts of the project should be presented in detail. Reviewing agencies and the public should be fully aware of these impacts before construction of a project. Individuals not associated with the proposal may bring different perspectives to the EIS and may identify problems unforeseen by the authors despite their attempt to be comprehensive and thorough. This is supposed to be one of the most important functions of an EIS. Even the best prepared EIS may be returned for more analysis because of problems identified by the reviewing agencies.

Both the beneficial and the adverse probable impacts of the project must be described in detail. All subsections under the first generic EIS topic, Description of the Existing Environment, should be discussed in terms of both the beneficial and the adverse probable impacts.

Description of the Techniques Intended to Minimize Adverse Impacts

There are almost always some techniques available to avoid or minimize adverse impacts. These are usually construction methods and designs that are widely used, although some unique methods may be developed for a specific project. Large impact producing differences should be proposed as alternative proposals and evaluated under the third generic EIS topic, Probable Impacts of Each Alternative. The techniques described in this section would normally be applicable to many of the alternative proposals.

Development of previously natural areas, for example, causes many water-related problems. The construction process exposes large surface areas to erosion. Paved areas, roofs, and other impervious surfaces do not allow precipitation to percolate into the soil so that great quantities run off into water courses, causing increased problems of erosion, sedimentation, streambank erosion, flooding, and contamination of water bodies by pollutants. Techniques have been developed that help mitigate these adverse impacts.

Some of the techniques used to control erosion related problems will be presented as examples of the types of techniques suggested for this section of the EIS. Tourbier and Westmacott (1974) list some of the techniques. Many of these attempt to maximize the amounts of natural and artificial protective covers on the soil of the construction site. Protecting existing vegetation, rapid establishment of grass by seeding or use of sod,

and use of mulches all act to absorb the energy of rainfall, thereby allowing water to percolate into the soil rather than to run off and to cause erosion.

Several of the techniques involve channelling and collecting runoff. The channels often use check dams of straw or other porous material to trap sediment. If the geologic formations are suitable, shallow grass-covered depressions called swales can be built to hold water until it percolates into the earth. Where space is at a premium, recharge basins, dry wells, dutch drains, or a wide variation on these designs are possible.

Reference: Tourbier and Westmacott, 1974.

Summary

An environmental impact statement must be designed for a specific project. There can be no single methodology or cookbook approach that is applicable to all impact statements. This section has presented the main topics to be included in an EIS and an order of presentation that will help identify alternatives, the significant impacts, and the tradeoffs involved with any project. Projects should be designed with these topics in mind. But if they are not, the EIS should raise issues that were not considered.

VI. WHAT HAVE BEEN THE ACCOMPLISHMENTS AND PROBLEMS WITH THE EIS PROCESS AND WHERE DO THEY LEAD?

As you have no doubt recognized throughout the paper, NEPA and its state and local progenies are extremely controversial. This section briefly summarizes the major strengths and weaknesses of the EIS process and provides our perspective on the controversies.

Strengths

One of the most important accomplishments of the EIS process on the Federal, state, and local scales has been its widespread use, at least prescriptively, as a technique for managing growth. The use of the EIS is an explicit acknowledgment that development requires early planning in order to avoid degrading the quality of the environment. It may be argued that Federal and/or state land-use laws would be a much better means of requiring early planning. In the absence of such legislation, the EIS helps fill the gap. In the words of David Kinsey, Chief of the Office of Coastal Zone Management of the State of New Jersey, the EIS has operated to "promote wider concern for the diverse elements of the environment in planning" (Kinsey, 1977). He further suggests that the EIS has acted as a mechanism to mediate in reconciling development needs and the integrity of the environment.

The EIS has been viewed as a "consciousness-raising" endeavor. It is seen as a serious turn away from the historical Faustian bargain implicit in development for the present-degradation in the future. Even among its critics, the EIS has warranted some deserved commendation:

> In addition to generating important environmental impact data, the process has often spawned a more comprehensive, interdisciplinary analysis, including secdary or indirect effects of a proposed action, and has stimulated an appreciation of the interactions of things. (Odell, 1976: 5)

Aside from these broad strengths, the EIS process has some very specific strong points. Since the NEPA requirement forces Federal agencies to prepare impact statements, a system of checks and balances between Federal, state, and local governmental levels is created through the review procedure. Although an agency can legally ignore comments when states or localities present strong opposition to a proposal, such comments are unlikely to be ignored. In the case of a state required EIS, the process has been described as conducive to greater cooperative interaction between state and local governments (Kinsey, 1977). The opportunity for public participation in Federal decision making processes is also enhanced because the EIS is legally determined as a "full-disclosure" document which ideally must incorporate the opinions of willing commentors. Finally, the interdisciplinary team approach of the EIS should lead to better science. To summarize, the EIS process should induce better planning, raise people's consciousness, result in better communication between scientists, and create a series of checks and balances.

From an operational perspective one may view the accomplishments of the EIS process purely from its past applications. During the period January 1970 to November 1977 approximately 8,588 draft or final Federal impact statements were prepared for review. The number of actual activities covered in these statements amounts to well over 100,000. As the number of states requiring impact statements increases, the number of activities under review also increases. In short, the EIS amounts to perhaps an unparalleled effort at monitoring the human effects on environmental quality, with

the broad objective of protecting and preserving the environment for our future descendants.

At the Federal level, as was previously pointed out, only 166 temporary injunctions were imposed out of a total of 8,588 proposed actions; and only four permanent injunctions occurred until the appropriate EIS was prepared. However, it is suggested that the review process has had more experience with project modification than elimination:

> . . . NEPA has been instrumental in the cancellation or postponement of some highways, dams, airports, nuclear waste disposal programs, outer continental shelf leases, and other proposals. More frequently, the process has resulted in shifts in location, design modifications, and other changes to mitigate undesirable environmental effects, including strengthened regulations. (Odell, 1976: 4)

One of the most publicized instances of close examination occurred in the Calvert Cliffs case. The court decision in this case required the Atomic Energy Commission (now the Nuclear Regulatory Commission) to develop new procedural processes for reviewing applications to construct nuclear power plants. The new procedures radically transformed the AEC's previously isolated review process into one that included participation of the applicant, other agencies, and the public in the environmental review process. These revised procedures have helped lead to many modifications in nuclear plant design, design of intake structures and cooling systems, revision of environmental monitoring plans, installation of fish screens, and new studies of alternative cooling systems.

A more recent example of the use of NEPA is the Cache River System in Arkansas. After six years of litigation under NEPA (the Environmental Defense Fund claimed that the EIS was inadequate), the Corps of Engineers' original proposal to dredge a major portion of a forest-wetlands ecosystem was drastically modified to include major conservation areas. Tripp (1978) contends that:

> the six-year NEPA litigation process, though nominally unsuccessful . . . delayed construction of an environmentally disastrous and economically questionable project [and] educated the public through scientific testimony about the value and functions of the natural resources which would be irretrievably lost, and about reasonable alternatives

Commenting on finding a solution with both economic and environmental benefits, Tripp concludes that it "probably could not have been accomplished without the NEPA process."

More recently NEPA has been instrumental in forcing agencies to examine more closely activities of moderate to intensely sensitive scope. The Bureau of Land Management prepared an EIS in 1974 on an annual 150-mile motorcycle race from Barstow, California to Las Vegas, Nevada over public lands and later approved the activity. After extensive environmental analysis of the impacts related to the event the Bureau rejected any further races. A more sensitive activity proposed by the Federal government involves alternative methods of natural gas shipment from the Alaskan North Slope to the lower forty-eight states. In adherence to NEPA a discussion of alternatives included the "Alcan" proposal "for a forty-eight-inch pipeline to be built along the Trans Alaskan Pipeline corridor from Prudhoe Bay to Fairbanks, then along the Alcan Highway corridor into Canada and across the Yukon Territory" (*Science,* 1977b). This alternative has the advantage of not intruding upon either the Arctic Wildlife Range or a similar wilderness region in the Yukon Territory. One other proposal would intrude upon both these areas, and still another proposal involves shipping the fuel as liquefied natural gas (LNG) – an alternative of dubious safety. Perhaps these alternatives would have been forthcoming without NEPA, but perhaps not.

At a vastly different geographic scale, regional, state, and local EIS officers have cited numerous cases of preservation of unique local environments because of the EIS. They vary from large amounts of parkland to isolated dunes and a few small cedar trees. Each of itself is probably not very important. Cumulatively they lead some people to conclude that the EIS process is worth the effort.

Weaknesses

Although the EIS represents a prescriptive approach to protecting the environment, critics have charged that it has been ineffective. The shortcomings of NEPA and of state and local EIS requirements are inherent in the processes themselves. Other problems accrue from institutional biases, and for economic reasons. These problems are briefly reviewed in this section, again focusing on the NEPA EIS.

The institutional problems associated with impact statements are of a legal and/or administrative nature. One of the greatest legal problems with the EIS process is derived from a fundamental contradiction in NEPA and many of the state and local statutes. On one hand, the law creates the conditions for integrating environmental considerations into agency actions to protect the quality of the environment as a procedural duty. On the other hand, a fundamentally procedural requirement such as Section 102(2)(c) avoids making demands upon an agency's substantive activity. An apparently defective substantive decision on the part of an agency may be exempt from legal imposition as long as it adheres adequately to procedural requirements.

A second important deficiency of the Federal NEPA law and many of the state laws is that they exempt private sector development from the EIS process. This shortcoming deserves special attention because private sector development accounts for the vast majority of development on the local scale. NEPA and its progenies have been administratively extended to private actions by using Federal, state, and other permit processes. Despite these clever extensions, many of the potentially harmful effects on the environment resulting from human activity are not addressed by an EIS or its equivalent.

Three familiar legal problems are briefly noted here. First, there has evolved a growing inconsistency in case

law concerning the interpretation of the Federal act. Trial courts and courts of appeal apparently disagree over the responsibility of an agency in the delegation of the preparation of an EIS. The appeals courts and Supreme Court disagree on the issue of whether or not a Federal action requires a project or a program statement. Although the Supreme Court asserts the final legal interpretation, most cases never reach this stage of review. An atmosphere of logical uncertainty hinders agency performance and engenders critical opposition on the part of citizen groups. A second problem is that the court system may not have the expertise or administrative capability to weigh adequately information of varying quality and quantity developed from widely divergent sets of disciplines and from persons with different value systems. Finally, administrators of EIS programs are disturbed by people who have used the process and the courts to further their own agendas (i.e., sewer pipe too close to their land or too far away).

One of the greatest drawbacks to the EIS process concerns administrative discretion. It has been contended that many actions with environmentally significant impacts are not accompanied by an EIS because agencies decide that the actions are not "major" or "significant," or do not constitute an agency "proposal" or "action" (Odell, 1976: 5). A strong movement may be beginning to exempt important activities and programs from NEPA requirements and from NEPA related litigation, for example, the Trans Alaskan Pipeline. The Alaska Gas Transportation Act, passed by Congress in 1977, allows the President to choose a gas pipeline route from among a number of alternatives. Congress has only to pass a resolution to waive provisions of NEPA (Arieff, 1978: 14). It is contended that such administrative encroachments "not only threaten the integrity of the law, but substitute political judgments for the informed decision making NEPA was intended to pursue" (Arieff 1978: 15). Other critics have also pointed out that significant policy changes take place only in response to "political pressure rather than voluntary commitment on the part of agencies" (Odell, 1976: 8).

As pointed out earlier, agencies differ in their attitudes toward the EIS requirement. Agencies that feel constrained by the requirement will try to circumvent its importance in decision making or present a biased analysis. Therefore, a problem with final EIS's is that they often become defensive documents packed with as much information as possible to protect the agency in case outsiders present a legal challenge. Although the information is interesting, it often amounts to a bundle of irrelevant material that avoids the significant environmental impacts of the proposal. This problem is especially evident in the often cursory and perfunctory discussion of alternatives. Rather than encourage the imaginative development of feasible alternatives, some agencies seem to obstruct these attempts.

Another of the most important categories of problems inherent in the EIS process involves scientific evaluation of impacts. No matter how detailed or comprehensive the document may be, there appears to be no way of ensuring that all significant scientifically ascertainable impacts will be included. At the outset it is known that some scientific facts will be missing simply because information or data are lacking.

A closely related problem concerns the accurate measurement and weighting of impacts. Many impacts do not have additive effects on the environment, but have synergistic, multiplicative effects. Some pollutants have specific chemical reactions that presently may be impossible to measure accurately. The impact of some chemicals is not known. Many chemicals once thought to be safe are now known to be carcinogenic (causing cancer), mutagenic (causing genetic changes) or teratogenic (causing birth defects). Today's environmental quality goals represent subjective estimates rather than definitive firm targets. In addition, methods of weighting environmental impacts (reviewed in Chapter Five) have definite limitations not always recognized or stated by their users. Overall, the general lack of reliability in estimating environmental impacts casts suspicion on the adequacy of many impact statements. And because most EIS's are viewed as advocacy documents, many people are suspicious of the data and the manipulation of data.

Trying to keep down the cost of complying with the EIS process complicates administrative and scientific problems. In a study of seventeen Federal agencies having extensive experience with the EIS process, CEQ reported that in fiscal year 1974 related costs were about $135 million (Council on Environmental Quality, 1975: 636-637). On the average, each agency spent approximately 1.025 percent of its total operating budget on the EIS process. A twenty-one percent increase in estimated costs for fiscal year 1975 amounts to a total of about $163 million. These costs include EIS preparation, review, and comments.

On the average a Federal agency may expend approximately 1.025 percent of its operating budget on the EIS process, but individual agencies vary in their EIS expenditures. Some critics have claimed that the EIS places a burden on the resources (i.e., staff and budget) of the agencies. The Bureau of Land Management (BLM) was directed by a district court in 1974 to examine the effects of livestock grazing on specific areas of public lands. These effects were to be documented in a number of impact statements –about 212 –by 1988, which would cover 150 million acres of public land. It is pointed out that

> the proposed actions under consideration in the EIS's are capital investments for Western rangelands, such as fencing, water holes, and other improvements. The total cost of these EIS's is expected to exceed $100 million (an amount equal to 10 times the annual budget for the investments themselves during an average year in the early 1970's). (Bardach and Pugliaresi, 1977)

For fiscal year 1974, the Bureau of Land Management expended about $3.8 million on EIS preparation and review (about 1.3 percent of its yearly operating budget). In light of the expected increase in costs because of the district court order, BLM will require greater appropriations from Congress to fulfill its NEPA derived obligation.

The most widely publicized economic problems associated with the EIS process come from developers and labor. Developers argue that the EIS process is basically a "no-growth" or "slow-growth" policy that leads to economic recession. They cite the time-lag inherent in preparing and reviewing impact statements and the inflationary impact on raw material costs. This inflationary impact is further increased when delays to a project are related to NEPA litigation and potential injunctions. Many label this an employment versus environment struggle. Delays to a project which last more than a month cause unemployment primarily in the construction industry. Extensive delays may have a ripple effect by reducing disposable income and retarding commercial activity, or by decreasing demand for raw materials and retarding primary production.

Some environmentalists, on the other hand, contend that the greatest economic problem associated with the EIS process is the grossly inadequate commitment of resources to the EIS process. They contend that these costs are justified by Congressional mandate to protect and preserve the quality of the human environment. Rather than causing unemployment, the costs of the EIS have created employment for environmental and social scientists, administrators, and lawyers, and have created a need for materials from the commercial sector. More importantly, it is contended that the costs related to EIS's may really result in future benefits by avoiding adverse impacts which may have imposed greater costs if left unchecked.

Ultimately, the biggest weakness of the NEPA EIS and many of its state and local progenies is that it remains extremely difficult to modify an agency's and private developer's decisions. The formal EIS comes too late in the planning of most projects. If comprehensive planning has not been done before the EIS stage, the best EIS may make no difference. The agency decision maker can build the project as long as the EIS describes the impacts. Discontent primarily with this last weakness of NEPA led Fairfax (1978) to argue that NEPA has wasted environmentalists' resources on paper shuffling, when they could have been put to better use on reforming agency decision making authorities and mandates.

NEPA as Part of an Evolutionary Process

In our opinion, the severe critics and defenders of the NEPA EIS process are politically naive. NEPA was the first comprehensive, politically acceptable step in an evolutionary process which should lead to refined impact assessments. In essence, NEPA says look before you leap, not that you cannot leap.

The provisions of NEPA are extremely general, far more general than the air, water, solid waste, and noise legislation passed at about the same time, all of which have been criticized for being too general. NEPA was a politically clever effort to introduce environmental factors into Federal agency planning. In addition, it indirectly tried to set a similar tone for private development, although Congress was unwilling to include such a provision in the Act directly.

Some agencies and by example some states and local governments have taken NEPA's bold but very general charge seriously. Defenders of the environment who realize how long environmental legislation takes to pass have taken NEPA's already broad mandate and tried to broaden it still further. Others have tried to interpret the general charge as narrowly as possible because they do not want outside interference. In short, NEPA and its progenies need refinement even beyond the latest revisions.

Impact assessment should move in the direction of requiring less of some proposals and more of others. For example, some states and localities require analyses for developments that seem to be beyond the capability of their staffs to analyze. A better way of controlling small development is to prepare plans based on holding capacity constraints. When a developer submits a plan for a forty-unit housing project, the project can be judged relative to the capacity of the planning area to accommodate the proposed project. Instead of having to prepare a detailed EIS as described in Chapter Five of this paper, the developer and agency can evaluate the impact of proposals based on the capacity of the area's sewers, water network, schools, soil, and many other factors.

At the other extreme, we strongly feel that current EIS requirements are too general to evaluate new technologies such as DNA and the breeder reactor. New technologies must be carefully assessed before they become totally integrated into our way of life. It should not be left to the discretion of a single agency to decide whether a new technology is developed. Likewise, an agency should not continue to develop a new but possibly deleterious technology merely because it has made a large financial investment in such development.

We suggest that economic, environmental, and health risk assessments be prepared in the case of new technologies. Such assessments should include comparisons of the action and no-action alternatives as well as full disclosure of the level of uncertainty inherent in the analysis.

Through evolution we hope that a revised EIS process will allocate large amounts of research funds to assess the risks of new technologies. Unfortunately, in the present situation the mass of EIS research funds go to making small risks smaller while potentially large risks receive relatively little attention.

VII. WHERE DO YOU FIND ADDITIONAL INFORMATION ABOUT THE EIS PROCESS?

Further information on the EIS process is available from published sources and interviews. The following are among the better books dealing with environmental impact assessment from a particular perspective. Law: Baker *et al.*, 1977; Engineering: Blisset, 1975, Cheremisinoff and Morresi, 1977; Planning: Burchell and Listokin, 1975, and McEvoy and Dietz, 1977; and Geography: Marsh, 1978, and Canter, 1977.

In addition, a new journal, the *EIA Review*, has recently published its first issue. Written at the Massachusetts Institute of Technology with funds provided by the Rockefeller Foundation, the *EIA Review* should be an excellent means of keeping up with the EIS process.

Merely reading about EIS's can give only an incomplete picture of the EIS process. Discussions with people who prepare and evaluate EIS's may be extremely enlightening, and because they constantly work with the process, they are well-informed. Ideally, participation is the best way of learning and we hope you will participate in an EIS project as outlined in the Suggestions for Class Use section of this paper.

VIII. WHAT IS THE GEOGRAPHER'S ROLE IN THE EIS PROCESS?

Geography has a long history of man-land studies (Hartshorne, 1959; James, 1972; Mikesell, 1974). Geographers are trained in some of the specific disciplines presented in Chapter Five, and to think about man-nature interactions.

Many EIS issues are inherently geographic. Yet, based on conversations with public officials and consulting firm representatives, we have found that relatively few geographers apply for EIS-related jobs. If you are interested in starting a new trend, one involving more geographers in the EIS process, your geographic training should give you some advantages if you supplement usual geographic skills with additional coursework.

Because geography is a spatial science, geographers should excel in answering scale-related questions. An EIS must grapple with the problem of defining the appropriate region. Frequently, some impacts extend over large regions, whereas others are limited to a community. Some impacts may leapfrog regions. And some situations may require dealing with one region and one time period for one set of impacts and other regions and other time frames for another set of impacts. Experience with issues of regional definition should help the geographer quickly recognize the appropriate scale of data and know the data sources relevant to the scale. Our experience also suggests that a geography background helps in evaluating the utility of data gathered for both areal units and for points. In addition to the ability to perceive and answer questions of scale, we believe that most geography curricula provide the broad scientific background, data handling, and understanding of man-land interrelationships required to do EIS work at the regional and local scales.

Private and government personnel (none of whom were geographers) responsible for regional, state, and local EIS preparation and evaluation gave a profile of a typical EIS analyst. The individual is adept at handling a broad spectrum of science and social science data and has a broad background of science and social science courses that enables the individual to integrate mentally all of the data presented in Chapter Five of this paper. Although specialists (e.g., air quality, geology) were seen as necessary for preparing and evaluating specific impacts, generalists do the guts of the work and the overall assessment of the impact.

The best advice we can give to geography students who are interested in working in the EIS process is to take a spectrum of systematic geography courses and to supplement these with courses in ecology, planning, soils, economics, and others from related disciplines. A minor in any of the above would help. Furthermore, it is true as a generalization that the most successful EIS workers have a masters degree which enables them to enrich and broaden their abilities to integrate. Finally, Schmid (1978) emphasizes that EIS's are written products and that skill in writing clear, logical English prose with a minimum of jargon is essential.

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